DISCOVERY

A MONTHLY POPULAR JOURNAL OF KNOWLEDGE

EDITED BY EDWARD LIVEING, B.A.

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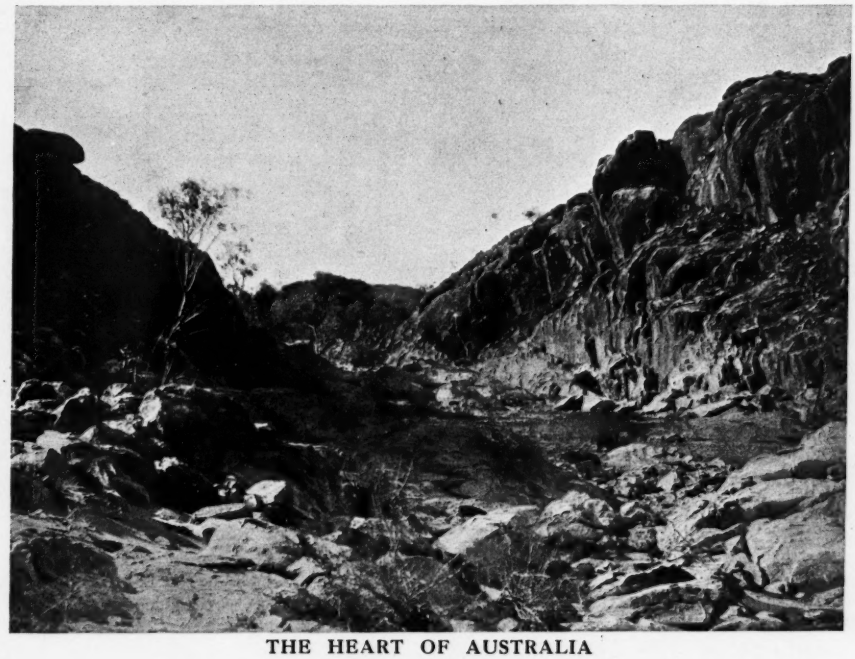

THE HEART OF AUSTRALIA

A gorge in the Macdonnells

(By courtesy of the High Commissioner of Australia)

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Editorial Notes

THE first organised gliding-tests in England have been concluded, and have astonished even the experts by the revelation of what is possible in a district not naturally the most suitable for the purpose. A mere onlooker is left with a feeling of admiration tempered with almost superstitious awe in contemplating such successes as those of Maneyrolle, Raynham, and Gray. For the personal factor—the flying sense—must be supreme in gliding, far more so than in the piloting of a modern aeroplane, which can be flown for miles without the pilot having to touch a lever. The glider, of course, has a steady wind for the most part to deal with—gusty weather is not for him. All the same, the air near the ground is never uniform, and the failures and minor accidents of the meeting proved more clearly than words can what difficulties the successful had to surmount, and what a delicate sense of balance and instantaneous action in quickly shifting circumstances are called for.

* * * * *

How much do we even now know of the varied conditions of the air within a thousand feet of the ground? Any airman will tell you that there are queer uncharted spaces in the air, and that now and again circumstances arise utterly unlike the normal. On one occasion during the war, in France, without any warning or any movement of the controls, a certain pilot's machine slowly assumed a "bank" of 45 degrees, in a manner completely unlike the ordinary "bump," which is so familiar to all who fly. Inexplicable disasters to experienced pilots are still an all too common feature of the conquest of the air; and some personal experience of seeing aeroplane accidents have convinced the present writer that the air is as full of hidden dangers as is the sea. It is such uncharted and intangible dangers that gliding may reveal to us. For the sea has been yielding its secrets ever since he of the oak and triple bronze first trusted his flimsy craft to it; but the air is an element which has been tested only by the last few generations.

* * * * *

Every week brings its fresh theory of the cause and nature of cancer, but not one of them has as yet yielded a hint of a cure. Some of these theories are fanciful—the mere brain-spinning of the arm-chair scientist. Such a one is that of a French writer who suggests that it is due to the union of a primitive organism—which has strangely eluded observation—with a cell of the body, in a species of unholy matrimony. Re-born, the cell sets out on the proliferating road which is typical of cancer, knowing neither end nor boundaries. He suggests that the theory might be tested by confining together in test-tubes living cells of the body and various arbitrarily selected organisms, in case one of them proved to be the culprit. But it is not probable that the matter will be put to the test.

* * * * *

A more reasoned hypothesis is presented by Sir George Beatson,[1] a name intimately associated with the problem for many years. He inclines to the opinion that it is to be solved by a closer investigation of the colour-bearing cells of the body, namely the pigment-cells. These are present in the skin (especially of negroes), in the eye, and in other places. There is evidence that cancer is commonest at the period in life when the body pigments are diminishing, when the hair is growing white and the skin often darker in small patches. Some cancers, too, are definitely composed mainly of pigment-bearing cells, and these

[1] The *Lancet*, September 23, 1922.

are the most malignant of all. The theory is only a theory as yet; but it is a deduction from a great many years of clinical experience—without which laboratory work alone can never hope to discover much.

* * * * *

The question to be solved is: "Why do some cells of the body suddenly begin unrestricted multiplication?" But there is another equally great mystery associated with cell-growth: "What factors ordinarily limit it, and why does the normal, well-intentioned cell divide and subdivide only to a certain definite degree?" There are, moreover, new growths of the body which, though beginning, as does cancer, in an untoward burst of proliferative energy, never invade other tissues, and never scatter their seeds broadcast through the body. In what relationship do such growths stand to cancer, and, most vexed question of all, can they ever become transmuted into cancers? The questions are easily asked—but the answers are not so readily found.

* * * * *

Marcel, arch-interferer with the ways of nature, has been amongst us, and has gone his way again. Why is it that humanity should crave for curls of oval shape, like a negro's, rather than for the fair, round symmetrical locks of the Western world? There is room for a scientific sequel to Darwin's *Expression of the Emotions in Man and Animals*, and we might entitle it *The Suppression of the Expressions in Man*. Beauty-spots—those curious bits of black plaster that may be seen on the portraits of great ladies of the eighteenth century—are as worthy of analysis as the snarl; the Marcel-wave as the elevation of the eyebrow in surprise. Deep in the soul of the community there seems to be cherished a conception of ideal beauty which includes such things as black spots, eccentric and undulating hair, carmine lips, and eyebrows too dainty to be seen. Whence comes this desire to fly from realities? Had Aphrodite lips significant of a cardiac lesion, and did Helen's hair wave? Was there a Greek Marcel, and did Achilles ever learn such lore when he sojourned among the maidens?

* * * * *

After all, hair is a strange survival from antiquity. There is a muscle to each hair, and a nerve too, yet we never use one of them save when Pickwick's fat boy and his sort are displaying their peculiar capacities. If our beauty seekers are chasing the phantoms of age-old æsthetic principles, perhaps it is not inappropriate that they should choose for their care such a poor scant relic of antiquity as the human hair, and bestow on it their meed of such undulation as may once have pleased our long-haired ancestors of the caves and the forests.

The Economic Development of Central Australia

By O. H. T. Rishbeth, M.A.

Reader in Geography at the University College of Southampton

In the true geographical and economic sense, Central Australia consists of an area of over 300,000 square miles, shaped somewhat like a bean, with its convex curve northwards. It stretches, from the Western Australian border at about latitude 25° S., east by a little south to include the south-west corner of Queensland and the north-east corner of South Australia. The northern boundary is roughly marked by the line Treuer Range–Barrows Creek Station–Boulia, while near the centre of the southern concave boundary is the rail-head, Oodnadatta, and Lake Eyre.

The development of Australia has proceeded centripetally, though so far mainly from the south and east parts. The early squatter and miner of the oceanic fringes have given place to the agriculturalist; the sheep-rearer has advanced through the ranks of the farmers and occupied the next inner concentric ring; the cattle industry has gravitated towards the centre and the inner north; the miner is eclectic.

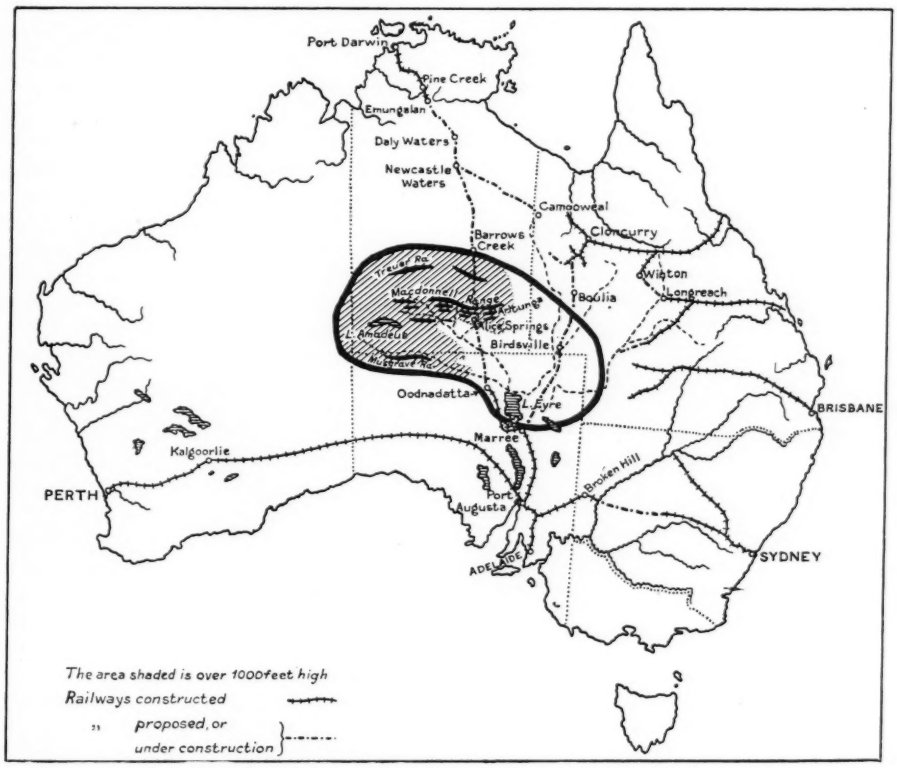
These are, of course, generalisations, for few land industries are mutually exclusive, especially in Australia, where a rather erratic climate encourages multiple pursuits. Indeed, one of the economic tests of Central Australia will lie in its capacity to produce either a constant sum of varied products or a relatively fixed quantity of one or two.

The response to this test is already fairly clear: Central Australia will be mainly a pastoral region—with probably a good range within those limits—and in the second line a producer of minerals. The "dead heart" of Australia has become a legend, and even in Australia "distance is often synonymous with aridity." But the heart of Australia needs no apologies. Beauty it has and riches, but its beauty is fickle and its riches are to be won sternly.

The days of the pioneer explorers and nameless prospectors are gone. The debt Australia owes to those heroic men, the mighty obstacles they overcame, their sufferings and our reward, should not blind us to the essential untrustworthiness of many of their conclusions. The British settler has much to unlearn in Australia. Judged by northern standards, a large portion of the continent is truly desert, but the young Australian has seen thousands of square miles of "desert" blossoming into wheat and cattle and

fruit land. The heat which blazes in the harrowing tales of our forefathers is no more than that which thousands of Australians live and thrive in to-day. It is not much greater, in fact, than that of more southerly and settled parts, and, though there are extremes of heat and cold, both are lightly borne because both are so dry. The winter climate is healthy and invigorating in the extreme. Certain parts suffer from severe dust-storms, and flies and mosquitoes are, in some seasons and places, sore plagues.

As far as concerns surface features, Central Australia



CENTRAL AUSTRALIA (MARKED WITH THE HEAVY LINE).

is not badly off. The east half consists of a vast low-lying plain varied only by rocky ridges, isolated flat-topped hills, and occasional belts of sand-ridge country. The west half is a plateau, with an average elevation of about 2,000 ft., cut across by numerous parallel ridges, running from east to west, notably the Macdonnell and the Musgrave Ranges, which rise to about 5,000 ft. North to south communications are not much impeded by these ridges, because most of them are low, while the Macdonnells are cleft across north to south in many places by striking steep-sided gorges, offering here easy passage and there splendid sites for dams. More serious are the broad, sandy river-courses and wide lowland flats subject to sudden devastating floods. These, sand-hills, dust-storms, and the frequent lack of a natural supply of non-mineralised water for boiler use, are the chief physical difficulties facing the railway and road engineers. For other means of transport the conditions are often trying, but seldom really difficult.

It is rainfall and geological structure which really stamp this region with its character. The Clerk of the Weather has not been kind to Central Australia. As one writer puts it: "Central Australia is a fore-caster's paradise! . . . [He] could predict fair weather every day of the year and only be wrong four times in a hundred." The driest part of Australia lies around and west of Lake Eyre, and the whole region except the north lies within the 10-in. line and is, therefore, in current climatological language, "arid" or "desert." It is just too far north to get much winter rain from the south, and far enough south to get only the fringe of the north monsoonal rains. Even worse, the rainfall is most erratic: the heart of Australia is not dead, but it is very fickle.

This has been a great curse. It accounts for the

extraordinary divergence of accounts of the country given by travellers. One man sees a pastoralist's paradise, with waving prairies, abundant pools, green scrub, and plentiful life; the next a withered wilderness filled with dust and whispers of death. It accounts for the successive waves of settlement—the brave and hopeful push out into the "Far North," the weary and bitter return. It accounts for the "gamble with nature"—the overstocking in good seasons and "taking the risk." And it accounts now for the somewhat selfish "ca' canny" understocking and the holding of too much land unimproved. There can be no security in Central Australia until the water-supply is secure.

What Nature withholds with one hand she gives with the other: it is to the geologist that the Australian turns for comfort in some of his sorest difficulties. In Australia geology is a first-line national service, and

A GORGE IN THE MACDONNELLS, WESTERN AUSTRALIA.
(By courtesy of the High Commissioner of Australia.)

geology speaks concerning Central Australia with a voice restrained, but not pessimistic.

The ancient rocks which form the ridges of Central Australia are frequently metalliferous: wide areas have been proved to contain good medium-grade ore: e.g., in the vicinity of Arltunga, gold and mica; at Hatches Creek, wolfram. But capital and then machinery, timber, water, and white labour are required to develop these deposits, and capital will not come until the enormous transport costs are reduced. Besides minerals, these ancient rocks generally provide belts of fertile soil, with a good water-supply around their bases, and between the parallel ridges of the Macdonnells are numerous rich, if still dry and "unimproved," valleys.

But by far the greater part of the area is covered with soft and relatively recent formations—sandstones, limestones, clays, and marls—sometimes forming wide alluvial plains. Undeniably there are considerable waste or semi-waste areas—sand and spinifex country with very poor scrub—especially in the western and south-western parts.

These soft formations have three qualities of capital economic importance:

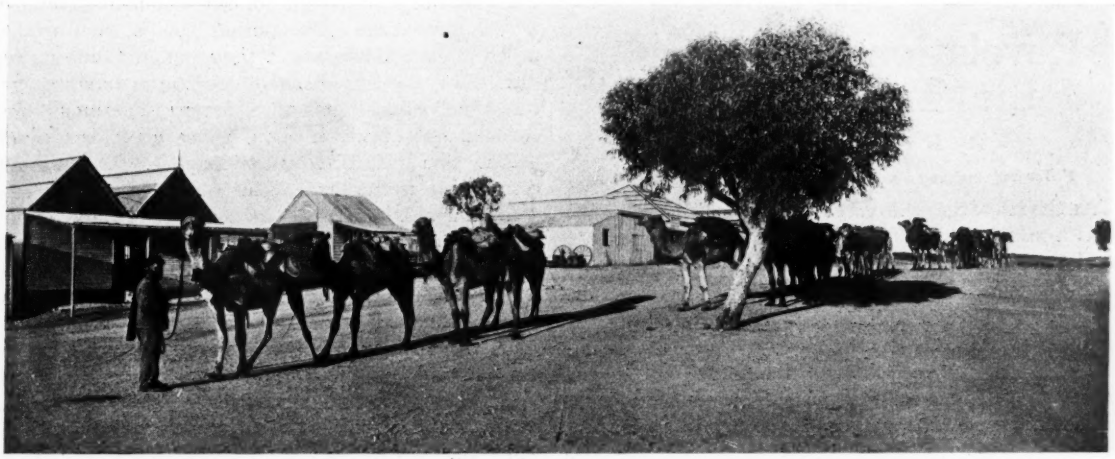
(1) They are often extremely rich and support a drought-resisting vegetation unsurpassed as fodder. The horses and cattle of Central Australia are of notable quality and condition. By careful selection among these desert grasses and bushes, by burning off poorer sorts (e.g., spinifex), the quality of pastoral land can be greatly improved.

(2) They are extremely responsive to climatic influences. Like most desert soils—dry, long fallow, sun-bathed—they are, if given water, capable of astonishingly rapid productivity. "In a night" the bare clay-pans fill, the grasses rush out and the sad scrub shines out as bright park lands. In places, 3 in. of rain at the right season are held to be sufficient for a year. At Alice Springs dates, figs, grapes, oranges, and green vegetables have succeeded admirably.

(3) They store water. Even sand-hills act as reservoirs and for some time after rains yield "soaks." The opening up of underground water is the first grand solution of Central Australian pastoral problems. Conservation of surface waters by means of dams, catchments, underground tanks, etc., is important, particularly in the Macdonnell Ranges, where large "gravitation" dams can easily be constructed, and the valleys thus rendered highly productive. Important too is the fencing in of existing pools and "native wells" and providing them with cattle ramps, for this may treble the lasting capacity of a water-hole and save many cattle which otherwise get bogged and die. But nearly all natural surface waters are more or less evanescent; not so subterranean supplies. These, though they vary much in various localities, fall into three main classes. Many quite shallow wells yield almost inexhaustible supplies of pure water. A second class of well is sunk to 50–150 ft., and these tap the "ground water" of a district, though this water is frequently hopelessly saline. Thirdly, there are the true artesian supplies from depths of 400–2,000 or more feet, generally highly mineralised and unfit for agriculture, but good for stock. The west boundary of the great Queensland artesian basin lies not far west of Oodnadatta and covers most of the east half of our area, thus constituting a radical difference between the east and west halves. Artesian water is by far the most valuable for pastoral purposes.

A beginning has been made, but much remains to be done to develop fully these underground supplies. Systematic well location and construction are necessary. The flow of artesian waters must be regulated

and distributed to good advantage. Cattle can range ten miles and sheep about five miles from their water supply, and after rains, when herbage is juicy, cattle may range even to fifteen miles. Wells then act as centres, and sometimes may save fencing—an important consideration in a country liable to bush-fires. Rabbits and dingoes must be systematically and uniformly attacked; stock routes with permanent wells opened up. The land must be scientifically parcelled and put out on permanent lease, and improvement of leased lands and adequate stocking must be stipulated in return for Government aid in well-sinking, etc. The carrying capacity and suitability of various lands for various animals—horses, cattle, sheep, goats, Angora goats—must be tested. All this will stabilise the pastoral industry and probably quadruple its output—an enormous gain over such a wide area.



£600 WORTH OF TIN COMING INTO MARBLE BAR FROM WOOLYELLA, WESTERN AUSTRALIA.
(By courtesy of the High Commissioner of Australia.)

But all this depends on better railway communications. At present the pastoral, like the mining industry, suffers under crippling disabilities, especially in marketing its products. Also droughts, though recurrent, are not universal at one and the same time. One of the great means of fighting droughts will be strategic pastoral railways, whereby stock can be shifted rapidly from area to area. Central Australia, properly linked, will play a large part in this strategic scheme. Australia is taking its north to south transcontinental railway seriously, and two main schemes hold the field. They are based on the two natural divisions of Central Australia indicated above. The one plan is to complete the Oodnadatta to Pine Creek railway roughly along the Overland Telegraph Line (western route); the other would take the line eastwards from Marree (Hergott Springs), up through Western Queensland and then curve westwards towards Darwin. This would undoubtedly open up much better and more pastoral country, and would probably be cheaper. Under this scheme the Oodnadatta line would also be continued to Alice Springs, thus tapping west Central Australia by a branch route. This much seems certain: the fine pastoral areas of the north-eastern portion of South Australia and Western Queensland will have to be opened up and linked somehow with the north to south railway system, because the economic drainage of the whole of Central Australia is eventually bound to follow the main lines of geographical configuration. That is to say, two systems, one from the north-east and one from the north-west, will unite somewhere south of Lake Eyre and, forming a "Y," will flow south to Port Augusta, which is capable of becoming a first-class deep-water harbour. Eventually, also, the northern fringe of Central Australia may drain economically northwards towards Asiatic markets.

Besides railways, greatly improved telegraphic, telephonic, and postal services will be needed if these lonely spaces are to be humanised, and light railways, motor traction, and even aeroplanes, will no doubt play their part.

Perhaps the most fascinating aspect of Central Australian development is its essentially pan-Australian character. Australia has increasingly to be thought of as a unity, and the development of Australia as an economic whole is making rapid strides. The solution of Central Australian problems is bound both to typify and to reinforce this tendency. Moreover, though distinct, the problems of Central Australia are largely bound up with those of the Northern Territory,

and the policy adopted in the one case will vitally affect development in the other.

The following works, dealing wholly or in part with Central Australia, will be found useful and interesting:

J. W. Gregory: *The Dead Heart of Australia* (1906).
Spencer: *Narrative of the Horn Expedition* (1896).
Spencer and Gillen: *Across Australia* (1912).
T. E. Day: "Explorations in Central Australia" (*Bulletin of the Northern Territory*, No. 20, 1916).
J. J. Waldron: *Central Australia* (1916).
Griffith Taylor: *Australian Meteorology* (1920); also his article in Meredith Atkinson's *Australia* (1920).

The reader might also refer to the columns of *The Times* (July 11, 16, 17, 1922) for particulars of Mr. McCallum's recent transcontinental journey; the *South Australian Register* (May 5, 1922) and *The Times* (November 3, 1922) for an account of a recent report on the proposed transcontinental railway; and Professor Hudson-Beare's presidential address on "Australian Railway Problems," at the British Association's recent meeting at Hull.

Revelations Concerning the Triple Alliance

By R. B. Mowat, M.A.

Fellow and Assistant Tutor of Corpus Christi College, Oxford

TILL the fall of the Habsburg Empire the Triple Alliance was a mystery to the European public. Its contents had never been officially published, and no definite knowledge of it had leaked out from the diplomatists. For years it kept the curiosity of historians on edge, and the most ingenious attempts were made in France, Russia, Italy, and elsewhere, both by professional students and publicists, to reconstruct its terms from information contained in contemporary history. But all the essays and monographs came to very little result; and meantime those statesmen and the official world of the "Triplice" remained perfectly impassive; nothing was divulged, and none of the challenging statements made by outsiders was contradicted. Down to the outbreak of war nothing was known—"an honourable testimony to the discretion of a class against whom the reproach of indiscretion has so often, and not unjustly, been made."

Even during the European War very little knowledge of the Triple Alliance came to light. In May 1915, after the entry of Italy into the war against the other two great members of the Triplice, the Austrian Government published four articles (Nos. I, III, IV, and VII). But nothing was said about the other articles, nor was there anything to indicate whether this was the only treaty forming the Triple Alliance. When Rumania entered the war in 1916, she surprised historians by stating in her manifesto that she had been a member of the Triplice, which, however, she considered to have been dissolved when Italy declared war upon Austria in 1915.

When at the end of the war the revolution occurred in Vienna and the Habsburg régime disappeared, the Austrian State Archives were opened to that eminent writer on diplomatic history, Professor Pribram. The result of his researches was a work entitled *The Secret Treaties of Austria-Hungary*, containing both the texts and a history of the negotiations which produced these texts. That part of Professor Pribram's work which gives the texts of the various treaties has been published, with a translation, by the Harvard University Press. Thus through Professor Pribram's work the veil has at last been lifted, and the whole body of the Triplice exposed to view.

From the account now before the public (an account which has not attracted the attention which it deserved) two facts stand out pre-eminent. One is, that the Triple Alliance contained not one, but several treaties at the same time. The second fact is, that it was never a very stable nor a very potent alliance, but that the really important diplomatic instrument was the Dual Alliance of 1879 between Germany and Austria, out of which the Triplice grew, but which was never superseded by the Triplice. To show the importance of the Dual Alliance it need only be said that it was according to its terms (not those of the Triplice) that Germany supported, and went to war on the side of, Austria in the crisis of summer 1914.

The text of the Dual Alliance has long been known. The circumstances out of which it arose are also known. Prussia, by the war of 1866, had driven Austria out of the Germanic system. Henceforth Austria ceased to have influence in Germany; at the same time she had lost her Italian provinces; there was no other path of ambition left to her but to exploit her Balkan claims. Nevertheless, although impotent in Germany, Austria was still a powerful military state, with an admirable strategical position in Central Europe. Hence her friendship and alliance, if they could be secured, were very important to Prussia. On the other hand, Prussia's friendship was important to Austria, always in danger of war with Italy (over the Trentino) or with Russia (over Galicia or over some Balkan question).

Bismarck would have liked to be friends both with Russia and Austria; but if he had had to choose between the two, he would have taken Austria, because Austria was the only Power who would have supported him in the war that he expected to come any day with France.

It so happened that by the year 1879 Russia was on rather bad terms both with the German and the Austrian Empires. Bismarck had been very displeased by the Russian Government's coolness (not

to say opposition) during the Franco-German "war scare" of 1875, which ended quite peacefully. Austria was also displeased with the influence which Russia acquired in the Balkans in the Russo-Turkish War of 1877–8. She feared that Russia might try to take from her the Turkish provinces of Bosnia and Herzegovina, which she had gained at the Congress of Berlin. So, out of the estrangement of both the Central European Powers from Russia, grew the Austro-German Alliance, which was signed by Prince Henry VII of Reuss for Germany, and by Count Andrassy for Austria-Hungary, at Vienna, on October 7, 1879.

The important part of this treaty was Article I, which stated that if "one of the two Empires be attacked by Russia, the High Contracting Parties are bound to come to the assistance one of the other with the whole war-strength of their Empires." Article II stated that if one of the two Empires were attacked by another Power which was directly or indirectly supported by Russia, the *casus fœderis* would also arise. Thus the German and Austrian Empires were very closely linked together; an attack from Russia on either party would bring both into the struggle; and, after the conclusion of the Franco-Russian Alliance in 1894, an attack by France on either Germany or Austria would involve hostilities with both.

This momentous Austro-German Dual Alliance was kept secret till 1888, when, on February 3, it was published simultaneously in Berlin and Vienna. There was one omission, however, from the text—Article III, which dealt with the duration of the treaty. This obscurity has now been cleared up. The treaty was, in the first instance, for five years; it was renewed again in 1883, and again in 1889, this time for three years. In 1902 a protocol was concluded by which the Alliance was automatically prolonged for periods of three years unless notice were given, at stated times within one of the periods, for considering its termination. In summer 1914 the Dual Alliance was in full force, and the mobilisation of the Russian Army in the provinces contiguous to Austria was accepted by Germany as the *casus fœderis*.

The Triple Alliance was a much less important affair; Professor Pribram's researches have fully justified the calmness, almost amounting to indifference, with which British Secretaries of State regarded it. It never superseded the Austro-German Dual Alliance: it was something additional to and outside it. Until 1888 the other members of the Triplice (i.e. Italy and Rumania) did not know of the existence of the Dual Alliance.

The Triple Alliance was founded by a treaty concluded between Germany, Austria, and Italy, at Vienna, on May 20, 1882. It was a kind of "insurance society" made by individuals who had no particular interest in each other. Italy at that time had very strained relations with France, chiefly because of the expansion of French power in Tunis. Therefore Italy wanted the support of Germany. But she would not get Germany's friendship while remaining unfriendly with Austria. Austria on her part was willing, even anxious, to have the alliance of Italy to prevent her from stirring up trouble among Austria's Italian subjects in the Trentino, Istria, and Dalmatia. Germany, of course, was glad to get Italy's promise of support, as the fear of a Franco-German war for Alsace-Lorraine was always in the minds of German statesmen. Italy, in point of fact, was the party who was least anxious for the alliance, and this explains why, in 1882 and at the subsequent renewals, she obtained the best terms. The Treaty of Alliance bound Austria and Germany to support Italy with their whole strength if she were attacked by France; and it bound Italy to support Germany only (not Austria) if Germany was attacked by France. Italy was not bound to support Austria if Austria were attacked by Russia singly.

Thus it will be seen that Italy got very large guarantees from the Alliance—the support of two great military empires—and Germany got a guarantee of moderate strength—the military power of Italy, which was rather far off geographically—while Austria got nothing but benevolent neutrality unless she was attacked by more than one Power. Thus the security of Austria lay, if anywhere, in the Dual, not in the Triple Alliance. The first Treaty of the Triple Alliance was to last for five years. Attached to it was a declaration made by the Italian Government, with the agreement of the other two signatory Powers, that the Treaty of Alliance could not "in any case be regarded as against England." The Austrian and German Governments made identical declarations. These declarations, like the text of the treaty, were secret; even the English Government knew nothing of them. Their secrecy is, to some extent at least, a proof of their sincerity.

One interesting point about the Treaty of Triple Alliance is its preamble, which stated that its objects were "to increase the guarantees of peace, to fortify the monarchical principle, and thereby to assure the unimpaired maintenance of the social and political order," in the three contracting States. The treaty was therefore a kind of "Holy Alliance," except that it claimed no right to interfere with the social and political order of other States. The treaty was to last for five years.

The Alliance of 1882 was made by a single treaty. The renewal on February 20, 1887, required three treaties. The first, which was signed by all three contracting parties, merely repeated the text of 1879.

The second was signed by Austria and Italy alone: it concerned the Balkans, and stipulated that, if either Austria or Italy should find itself compelled to modify the *status quo* in the Orient, either by a temporary or permanent occupation of part of it, this should only take place after a previous agreement between the two Powers based on the principle of a reciprocal compensation. A third treaty between Germany and Italy engaged the former to aid Italy if this Power should find it necessary to take action against France in the Vilayet of Tripoli, in the Moroccan Empire, or even "in French territory in Europe." And if, at the termination of such a war, Italy should "seek for territorial guarantees with respect to France" (i.e. if Italy should wish to annex a part of Savoy or Nice), Germany would present no obstacle.

Thus it will be seen that Italy at the renewal of the Triple Alliance considerably increased her advantages: she got an Austrian guarantee to share in any partitions in the Balkans, Adriatic, and Ægean, and a German guarantee of support to any territorial aims at the expense of France either in Europe or Africa. In return she gave promise of support to Germany in a French war, but only if the war was one of "aggression, without direct provocation, of France against Germany." To Austria, Italy promised military support only in the event of an attack by two Powers.

On October 30, 1883, Rumania had joined the Triple Alliance by a dual treaty with Austria, according to which the two Powers agreed to assist each other, if either was subjected to an unprovoked attack by a third Power. By a separate treaty of the same date Germany undertook the same obligations. Italy did not accede till May 15, 1888, and even then only so far as to undertake "to take counsel" with Austria and Rumania in the event of the *casus fœderis* taking place. The engagements of the three Powers with regard to Rumania were renewed in identical terms in 1892, in 1902, and in 1913. This last renewal was for a term of seven years.

The third Treaty of Triple Alliance was concluded on May 6, 1891, at Berlin. For this occasion the three treaties of 1887 were fused into one tri-partite instrument. The terms remained practically unchanged; the three Powers, though in the same treaty, undertook different obligations to each other. Article IX stipulated that, if Italy found it necessary to take measures to change the *status quo* in North Africa (Cyrenaica, Tripolitana, and Tunisia) with the support of Germany, "the two Powers would seek to place themselves likewise in agreement with England." Great Britain had already (on December 12, 1887) given her adhesion to "nine points" of the Austrian and Italian Governments relative to the maintenance of the *status quo* in the East (i.e. the Balkan régime). When the Triple Alliance was renewed in 1891 a protocol was attached to the treaty stating that the High Contracting Parties would exert themselves to obtain a similar accession of England to the treaty's stipulations concerning the North African territories. But Great Britain gave no such adhesion. Nevertheless she had come fairly near to the Triple Alliance, especially at the time of the Heligoland-Zambezi agreement of 1890. In 1891 she had the chance of definitely coming within the Triplice orbit, but took no action.

From this time the Triple Alliance became of less and less importance; and although renewed by a tripartite treaty on June 28, 1902, and by another tripartite treaty on December 5, 1912 (both times with the provisions unchanged), it was of little effect. The reason was that Italy's position in Europe was no longer consistent with the Triplice. She had got over her trouble with France, probably owing to some understanding which has never come to light, that France would not object to her annexing Tripoli. She had given up any idea of recovering Nice and Savoy, but on the other hand her longing to unite with her nationals who were under Austrian sway was stronger than ever. Moreover, the Italian and Austrian Governments found almost endless cause of friction in their respective handling of the Balkan clauses of the Treaty of Triple Alliance. On the side of Germany, too, the situation of the Triplice was no happier. Italy had always been very careful to insert saving clauses in protocols with regard to England; and in 1896 she had gone so far as to notify Germany and Austria that she could not take part in a war against England and France jointly. Although the Central Powers refused to take note of this declaration, they must have understood that all subsequent renewals of the Triple Alliance were subject to this condition. Thus the Triplice became of no military importance; it was useful as constituting a friendly group of States, with most favoured clauses as regards commerce; but in military affairs it no longer counted. Everything turned upon the old Austro-German Dual Alliance.

AUTHORITIES

Owing to the secrecy which was maintained over the Triple Alliance till 1919, all the standard works are in this respect almost purely speculative. The full texts will be found in Pribram: *The Secret Treaties of Austria-Hungary*, vol. i, with translations by D. P. Myers and J. G. D. A. Paul (Harvard University Press, 1920). There is a good short introduction to the texts. Some of the later documents were also printed from the archives of the German Foreign Office by Kautsky, in *Die deutschen Dokumente zum Kriegsausbruch* (Charlottenburg, 1919), band iv. The memoirs of the Baron von Eckhardstein (1921) also give some facts about the efforts of the German Government to obtain the alliance of England just after the conclusion of the Austro-German Dual Alliance.

Ink Pigments in Writing

By C. Ainsworth Mitchell, M.A., F.I.C.

POLICE reports abundantly prove that the crime of forgery frequently engages the attention of our magistrates. This is not surprising if we remember that the means are in the hands of all who can write, and that bankers' cheques are a common medium of exchange. The evidence usually demanded by the prosecution is that of the handwriting expert, who bases his opinion on the form and peculiarity of the writing; but there is evidence of another kind, less known to the public, namely the chemical examination of the ink or pencil marks on the documents, which is often not only more trustworthy but actually throws more light upon the mystery. Suppose, for example, additional letters have been added to a cheque, it is comparatively easy by chemical means to ascertain whether or not the interpolated characters have been written with the ink used for the body of the document. There are other methods, of course, which are useful in deciding on the genuineness of documents, photography for example, but in this article we shall confine ourselves to describing what is known about, and what can be learned from, the ink pigments which are used in writing, partly as matters of interest, and partly in their relation to the genuineness of documents. For this purpose some characteristics of ink must first be described.

The principal kinds of inks employed at the present time are known as carbon ink, iron-gall ink, and aniline ink. There are others, but these are the principal three. The ink in common use in this country, the familiar "blue-black," is a mixture of iron-gall ink and a blue aniline ink; it is best to discuss it, therefore, after its constituents have been described.

Carbon ink is not generally used for writing purposes in this country. Such inks are used in Europe only in the form of Indian ink or "safety" inks, to which lampblack, which is the basis of all carbon inks, has been added to render the pigment proof against the action of chemicals. Carbon inks, however, are still used in Egypt and in the East for ordinary writing, and are in general use everywhere for printing. The characteristics of a carbon ink are (1) its colour—a black which does not, in most cases, vary with time, and (2) its resistance to bleaching agents. An ordinary blue-black ink, for instance, may be bleached by a solution of the chemical sodium hypochlorite; not so a carbon ink. The two are consequently easily distinguished.

Carbon inks are the oldest class, and were known to antiquity. A chemical examination of ancient writing has thrown interesting light on their use in the past. Sir Humphry Davy found that the ink on the papyri unearthed at Herculaneum was a carbon ink with no traces of iron in it. He concluded that the Romans had not discovered iron-gall inks. Astle, who was Keeper of the Records at the Tower at the close of the eighteenth century, attributed the blackness of inks upon old manuscripts, dating from the ninth to the fifteenth century A.D., to their being carbon inks; but Blagden, who examined them chemically in 1783, failed to "find any trace of a black pigment" (due to carbon), but found iron in every case. The conclusion he drew, therefore, was that these ancient writings must have been done with the second class of inks, the iron-gall inks in common use in his own day. It is probable that the transition from the old

FIG. 1.—IRON-GALL INK. PERIOD 1723.
Magnification 20.

carbon inks to the modern iron-gall inks occurred in the seventh or eighth century A.D., although for some centuries later both were in use. An Egyptian document recently examined by Mr. Lucas, a portion of the Old Testament in Arabic (A.D. 1312), was found to have been written in two kinds of ink, one a carbon ink, the other an iron. These inks were not mixed, but used separately. Ancient carbon inks are not always as black as might be expected, being occasionally yellow or pale brown. Sometimes this brown colour is due to iron compounds, sometimes to those of other elements, but it is probable that these bodies were not deliberately mixed with the carbon for a specific purpose, but were mere impurities associated with the grade of carbon used in making the ink.

Iron-gall ink forms the principal, but not the sole, constituent of the ink in general use in European countries. It is made from a compound of iron, known

as ferrous sulphate or copperas, an extract of nut galls which contains tannin, and a solution of gum. This mixture when freshly made gives only a very faint colour on paper, but it has the property of

FIG. 2.—BLUE-BLACK IRON-GALL INK FIVE YEARS OLD, SHOWING DARK MARGINS CAUSED BY PEN NIB.
Magnification 20.

gradually combining with the oxygen of the air to form a compound which is coloured black. It first forms a tannate of iron containing about 5·5 per cent. of iron, and, until this tannate has been formed, the writing is to some extent soluble in water, and so capable of yielding a copy when pressed with moist absorbed paper. Some inks, indeed, are capable of yielding a copy in this way for a week or more. After this insoluble tannate has been formed, it combines further, but slowly, with the oxygen of the air to form a second tannate containing about 8 per cent. of iron. The writing then becomes stable. This body is relatively insoluble in water and dilute acids, and is of a resinous nature. Consequently an iron-gall ink after, say, six months (before the second tannate has been formed) will not behave in the same way, when treated with certain chemicals, as the same ink which has had eight or ten years in which to become stable. This property, as will be described later, is employed in examining suspected documents.

There are changes, too, which may be seen with the naked eye, or, more closely, with the microscope. At first, as has been said, the writing is almost colourless, but in a week or two if the written page be left open to the air and strong light, or in a year or more if it be written in a book and the book kept shut, the writing appears black. This progressive change of colour is entirely absent in pure carbon inks. Iron-gall ink is also easily distinguished from carbon inks in that it is easily bleached by some bleaching agents. Its characterictics, therefore, are three: (1) its change of solubility in acids and water with time; (2) its gradual change of colour to black with time; and (3) its property of being bleached by suitable bleaching agents.

The class of aniline inks is that most recently discovered. These inks are made from aniline dyes, the first of which, mauve, was discovered in 1856. These dyes now provide us with inks of all the colours of the rainbow. Eosine is the commonest basis of red ink, methyl violet of violet ink. But for ordinary purposes of writing, aniline dyes by themselves are not used in this country very much. In the East, on the other hand, they are largely used even for important documents like wills, promissory notes, deeds of sale, and receipts. They have the demerit of fading on exposure, but this change with time is not a progressive one like that of iron-gall inks; the nature and the extent of the exposure conditions the appearance of the ink much more than mere age. Many aniline inks are easily bleached when treated with suitable chemical reagents, and others change colour. The characteristics, then, of an aniline ink are: (1) it is of modern manufacture; (2) its age cannot be told from its colour; (3) it is easily bleached or its colour is easily changed by certain chemical reagents.

A few words now about blue-black writing ink. In former days iron-gall ink sufficed for the purpose of writing, the ink being exposed to the air before use to darken by the formation of the black tannate of iron. In modern ink this preliminary change due to oxidation is omitted, and a colouring matter, such as indigo, is added to give an immediate coloration so that the writer may see what he is doing. The indigo or an aniline dye immediately provides the blue; the iron-gall ultimately the black. As the iron-gall constituent oxidises gradually, becoming black, the colour changes from the bright blue of the aniline colour to a deep violet which results when the black pigment has formed. This change in colour proceeds fairly rapidly, as common experience shows, in the light, and more gradually in the dark, but in any case is usually complete in the course of a few months. Now if the ink upon a document supposed to be two or three years old be of a bright blue colour, and if chemical analysis prove it to be an iron-gall and not an aniline ink, the fact is suspicious. If, further, the ink subsequent to examination becomes progressively more violet on exposure to light and air, it is almost certain that the document is not so old as it is said to be, for, if it were two years old, the maximum intensity of colour would long before then have been reached. After writing has attained its maximum intensity of colour, a further gradual change due to oxidation takes place, which is not usually complete until after about four years.

It is owing to the use of different pigments for this provisional colouring matter that it is often possible to distinguish between the inks of different manufactures in writing. By treating the writing with dilute acid the iron tannate may be bleached, leaving the aniline dye available for examination. Whether or not provisional colouring matter of an ink is an aniline dye may be of importance. During the last years, entries in family Bibles have been produced in support of claims to a pension, but the presence of an aniline dye in the ink, on more than one occasion, has proved conclusively that the entries were forgeries.

The different proportions of iron and tannin from various sources also contribute to the character of the reaction given in ink by writing. An expert, after a series of systematic tests with his reagents, and using an apparatus called a tintometer to compare the changes in colour of the ink produced by the reagents, can frequently tell one kind of a blue-black ink from another with certainty. The first occasion on which the method was used in an English Court of Law was at the trial of Brinkley in 1907, when it was proved that an alleged will was written in three different kinds of ink.

Judging the approximate age of an ink is generally much more difficult than deciding the identity of two inks. There are certain distinct differences in the microscopical appearance of very old and of modern inks. The latter show a much more crystalline appearance, mainly due to the pigment attached to the fibres of the paper, and it is often possible to see dark margins to the lines due to the greater absorption of pigment at the places where the pressure of the divided pen nib was applied. This is illustrated in Figs. 1 and 2.

It was mentioned above, when the properties of an iron-gall ink were being described, that comparatively new inks are smudged when treated with certain reagents, while older ones either do not smudge or are affected only very slowly. This method of deciding the age of the ink on a document was used by the writer in the case of *Rex v. Pilcher* which was tried in 1910. It was found that the ink in the body of a will, alleged to be eleven years old, and of all the signatures, reacted immediately with several reagents and gave a copious smudging of the blue pigment, while all indications of the black pigment at once disappeared. Its characteristics therefore did not agree with those to be expected of an ink eleven years old. When similar tests were applied to inks upon a series of cheques written by the lady who was alleged to have signed the will, a fairly rapid reaction and smudging was found on cheques two or three years old; much less reaction and smudging on cheques five years old; little reaction and almost no smudging on cheques six years or more old, and no effect at all for a long time on cheques as old as the will was said to be. It was deduced from this that the ink, and therefore the will, could hardly have been six years old. Moreover, the ink of the cheques was the same kind of blue-black ink as that on the will, so that the comparison of their behaviour to reagents was a fair one.

In Fig. 3 the behaviour of writing of 1909 in the presence of dilute acid is compared with that of writing of 1921.

Of course common sense is sometimes a sufficient guide in deciding the authenticity of handwriting. An ancient ink, for example, cannot be genuine if it contains an aniline dye. An interesting case may be quoted from Mr. Lucas's book on *Forensic Chemistry*. A register was presented in Court in support of a case. The dates of the entries extended over more than a year, and it was stated that the register had been kept and entered up in an office. The book, however, was clean and new-looking, and quite free from dirt and dust, the ink was a bluish-green aniline ink, and so could not be dated from chemical evidence, but it was of exactly the same colour throughout, and the writing was in the same hand and was all done with the same or a similar pen, but showed signs of haste or fatigue towards the end. In two instances an entry which belonged to several lines below had been made and afterwards erased, and the dots under a word to indicate repetition, which occurred plentifully on every page, had in some instances been written vertically on a number of different lines at the same time, the ink showing progressively diminishing intensity of colour from the top to the bottom of the page. It is needless to add that the register's genuineness was not established.

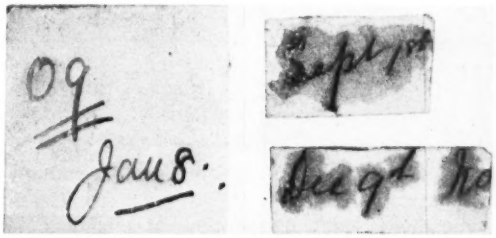


FIG. 3.—EFFECT OF A REAGENT ON BLUE-BLACK IRON-GALL INKS OF THE SAME TYPE IN WRITING OF 1909 AND 1921.

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(An article by the same author on *Pencil Pigments in Writing* will appear in the January number.)

Between the Covers

HEAD-HUNTING IN FORMOSA

In our Editorial Notes for last October we mentioned that "the sudden stopping of head-hunting in the Solomon Islands left so great a gap in the daily interests of the natives that they very speedily lost their virility." The extremely important part which this custom plays in the social organisation of many primitive or semi-primitive races is well illustrated by the following account of its practice amongst the native tribes of Formosa, the island, now governed by the Japanese, which lies off the east coast of China. This account occurs in Mrs. J. R. Montgomery McGovern's newly published book, *Among the Head-hunters of Formosa* (T. Fisher-Unwin, Ltd., 15s.): "I think that anyone who has lived among a head-hunting tribe will realise how closely this custom is interwoven with the fabric of their whole social organisation. It regulates the social and political standing of the men of the tribe; it is directly connected with marriage—no head, no wife; and is reflected in the games, the songs, and the dances of the people. Moreover, head-hunting is regulated by a code as rigid as the code of 'an officer and a gentleman' in so-called civilised society—and is rather less frequently broken.

"Deniker, in speaking of the Dyaks of Borneo (see *The Races of Man*, p. 251), aptly remarks: 'A number of acts regarded as culpable by the codes of all civilised states are yet tolerated, and even extolled, in certain particular circumstances; such as the taking of life, for example, in legitimate defence, in a duel, during war, or as a capital punishment. Thus, in recalling examples of this kind, we shall be less severe on a Dyak who cuts off a man's head solely that he may carry this trophy to his bride; for if he did otherwise he would be repulsed by all.' The same charity for which Deniker pleads in judgment of the Dyak may well be extended to the Formosan aborigine, who never thus seeks private vengeance, whatever his provocation, on one of his fellow-tribesmen, private disputes being always laid before the chief—male or female—of the tribe or before the chief priestess, or a convocation of the elderly women of the tribal group. Also when a Formosan has voluntarily given his word to refrain from head-hunting, it is said—and my personal observation would tend to confirm this—that he never breaks it.

"The tribes among whom head-hunting still exists are the Taiyal, the Bunun, and the Paiwan, though among the Bunun and the Paiwan to a lesser extent at the present time than among the Taiyal. Among all the other Chin-huan tribes it existed within the memory of the older generation still living.

"Among the Taiyal tribe—the great tribe of the northern part of the island—one can tell at a glance who has 'a head to his credit,' by the presence, or absence, of the tatto-mark on the chin. Occasionally one sees the insignia of the successful head-hunter tattooed on the chins of young boys. This indicates that these boys are the sons of famous head-hunters and that their hands have been laid upon heads decapitated by their fathers; or that they have carried these heads in net-bags upon their backs. This, by tribal code, entitles them to the successful head-hunter's tattoo-mark. Incidentally, it must be understood that while Taiyal are—largely because of their peculiar form of tattooing—usually regarded as a single tribe, they do not so regard themselves, but are composed of a number of sub-groups (it is said twenty-six), who regard themselves as separate units, and who consequently go on head-hunting expeditions against each other.

"When a boy attains maturity he is supposed to celebrate this by going on his first head-hunting expedition. Usually several boys of about the same age go together on their first expedition, accompanied by older and more experienced warriors of the same group or sub-tribe. Before going on such an expedition an omen is always consulted—usually a bird-omen—and it depends upon the favourable or unfavourable indication of the omen as to whether the expedition is undertaken forthwith or is postponed. The Taiyal consider it more auspicious to set forth on such an expedition with an odd number of men. They seem to think the chances will be greater of securing a head, which will count as a man, and thus make up the 'lucky even number' with which they hope to return to the village."

THE HARNESSING OF THE JORDAN

In view of the recent Rutenberg controversy in the House of Commons, the following extract from an article by Henry Woodward Hulbert on *Irrigation and Water-power in Palestine*, which appeared in the November number of our excellent contemporary the *Scientific American* (Munn & Co., New York, 35 cents), is of considerable interest:

"For many years the water-power possibilities of the vast depression of the Jordan Valley in Palestine have been evident to all engineering observers, and especially since Lieutenant Kitchener (later Viscount) completed the survey of Western Palestine for the Palestine Exploration Fund. That strange river rises but a few hundred feet above the level of the Mediterranean and soon is checked in its course by the extensive morass of the Huleh Basin. As this can never be drained successfully, it furnished the first opportunity for an extensive barrage, below which is a drop of 700 feet

within a 10-mile course to the Sea of Galilee. At this point it is certain that many hundreds of thousands of horse-power can be generated.

"The second power-house in the system would be constructed at the outlet of the Sea of Galilee, where a barrage can be thrown across the Jordan as it issues from that huge basin. This would hold the waters of that sea at least at high-water mark. Possibly it may be found that the level could be brought two or three feet higher without serious damage to the shore privileges. Here again many hundred of thousands of horse-power could be generated.

"In the 60 miles (as the crow flies) from Galilee to the Dead Sea the drop is about 600 feet. The waters of the Jordan may well be diverted at this point from the winding channel and carried down by canals on either side of the valley at proper levels for irrigation purposes. There is no richer or more neglected land in the world than would thus be opened for cultivation. A considerable body of this water must be carried 30, 40, or even 50 miles for use in the lower valley and can be used at every drop to generate more electricity.

"Three considerable perennial streams flow into the Jordan and the Dead Sea from the east below Galilee, the Yarmuk (Hieromax), the Zerka (Jabbok), and the Arnon. Here again large irrigation opportunities present themselves and incidentally water-power privileges. The first two of these and other smaller streams from east and west should be led into the two canals carried down the sides of the Jordan Ghor at high levels. Possibly a total of a dozen barrages across the mouths of wadies coming down into the valley could impound all extra fresh waters and receive the spill-over from the canals during the rainy season (November to April). The plan would be to use up entirely the fresh water of the Jordan system, so that eventually none of it shall flow into the Dead Sea. By the power generated, water could be pumped to reservoirs at high levels on either side of the Jordan Valley, thus greatly extending the irrigation of rich soils never yet brought under continuous cultivation.

"In all this we have only the ordinary scientific handling of a river system for highest agricultural and water-power purposes. But in discussing the Jordan Valley we have the absolutely unique situation of a river rising but a little above sea level and spending its complete course in descending ('Jordan' means 'the descender') to the depth of 1,300 feet below the sea level. At one point this strange depression approaches the inexhaustible reservoir of the Mediterranean within 25 miles, five of which lead through the rich alluvial plain of Acre to the foothills of Galilee, leaving only 20 miles of tunnelling through soft limestone to the Jordan watershed, whence the waters of the Mediterranean can be carried down the 1,300-foot descent to the Dead Sea through a straightened river-bed by a system of barrages by which to extract from the descending mass of waters the last degree of horse-power possible.

"When, some years ago, the experiment was broached of letting the Mediterranean waters into the Jordan depression by a canal via the Kishon Valley and filling up the whole valley of the Jordan and then cutting through the intervening barrier from this inland sea to the eastern upper prong of the Red Sea for ship canal purposes, paralleling the Suez Canal, the whole project, after careful investigation, was given up. The engineers, granting that levels and cuttings were quite practicable, brought in the verdict that, so great was the evaporation in the deep Ghor of the Jordan Basin, no plan could be devised that would let in water fast enough to fill it up. This being the case it is clear that the Mediterranean water can be thus turned into this deep depression up to the limit of its evaporating possibilities. This can only be determined by experiment, but there cannot be any doubt that the amount of electrical fluid thus to be generated would surpass many times over the total capacity of the Niagara tunnels."

THE DROUGHT OF 1921

"CONSIDERING the year as a whole, it is seen at once that 1921 was, in certain areas, a year of unprecedentedly small rainfall. Sufficient data exist to construct maps showing the percentage of the average rainfall occurring in the British Isles in each year back to about 1850. Since then there is no doubt that the only years which are in any way comparable with 1921 were 1854, 1864, 1870, and 1887. The last-mentioned was by far the driest year hitherto known to have occurred in the British Isles. The year 1858 was also dry, especially in England and Wales, but not quite as dry as any of the other years mentioned."

Records of more than 75 years' duration indicate that "for London 1921 was the driest year for at least 148 years, and as London was by no means the driest district relative to the average, it may be justifiably inferred that in 1921 a considerable part of the south-east of England had the least rainfall for at least a century and a half, and probably for a still longer period, though complete statistical proof is wanting."—From *The Drought of* 1921. (From *Quarterly Journal of the Royal Meteorological Society*, vol. xlviii.) By C. E. P. Brooks, M.Sc., and J. Glasspoole, B.Sc., A.I.C.

THE PROVINCE OF DARFUR

IN *The Geographical Journal* (2s.) for November an interesting account is given of the modern history

of Darfur (Western Sudan) by Mr. E. G. Sarsfield-Hall, B.L., LL.B., of the Sudan Civil Service. The author writes :

" Darfur, or the country of the Furs, was formerly one of a chain of ancient kingdoms which stretched across the African continent from east to west, and of which Abyssinia alone survives to-day as an independent state. Its original inhabitants were a Negro race, who lived a primitive existence in the more mountainous parts of the country, and were ruled by a line of pagan Dagu sultans. In the sixteenth century, however, they were brought into touch with Mohammedan influence, and thereafter gradually converted to Islam. With their conversion, the sultanate passed into the hands of the arabicised Kungara branch of the Fur, and in 1596 Solong, the first Mohammedan sultan of Darfur, whose mother was an Arab, ascended the throne.

" The old Dagu sultans had been content to rule a circumscribed area surrounding their mountain fastnesses, but their successors had more ambitious ideas and soon set about extending their dominion. Descending from the great Marra range, they not only conquered the wide plains adjoining it, but also overran the neighbouring province of Kordofan, and finally penetrated victoriously as far as the Nile. Their triumph was, however, short-lived, and the warlike Fungs soon commenced to drive them westwards whence they had come. By 1770 they had lost even the province of Kordofan, and, though they retook it a few years later, it was finally conquered from them in 1822 by Mohammed Bey Daftardar on behalf of the Egyptian Government.

" After this reverse the Darfurians retired westwards, but fifty-two years later Darfur itself was annexed to Egypt by the famous Zubeir Pasha, who advanced into it from the south on the pretext that the Darfur sultan was unable to control his people and prevent them raiding into the Bahr-el-Ghazal. In 1877 General Gordon visited Darfur, where Sultan Harun was in revolt, and Suliman, the son of Zubeir Pasha, was carrying out extensive slave raids at the head of a large body of well-armed followers. He succeeded, to a certain extent, in restoring the confidence of the Government troops and in pacifying the country, but was compelled to return to Khartoum, leaving Sultan Harun still at large and Suliman but temporarily submissive.

" The Fur sultans hotly resented the annexation of their country by the Egyptians, to whom they refused submission, and against whom they carried on a desultory warfare from their strongholds in Jebel Marra. Whenever a sultan was slain another arose in his place, with the result that the Egyptians never succeeded in completely pacifying the country. In 1882 the Mahdists overran Darfur, and two years later their representative, the Amir Mohammed Khalid (Zogal), succeeded in capturing Abdullahi Dud Banga, the last of the sultans to defy the Egyptian Government. Peace reigned until Mohammed Khalid, being summoned by the Khalifa to Omdurman appointed Yusef, the son of the late Sultan Ibrahim Garad, to rule Darfur during his absence. No sooner was his back turned than Yusef raised the standard of revolt, and though he himself was killed in 1888, a small but resolute band of Furs continued to defy the Khalifa's authority. In 1896, however, Ali Dinar, the last of the rebel sultans, finding himself deserted by the greater part of his followers, surrendered to the Dervish Amir Abd el Gadir Wad Dalil. He was sent to Omdurman, and remained there until the eve of the battle of Omdurman, when he fled westwards, intending to seize the throne of Darfur. One Ibrahim Ali, a nephew of the late Sultan Yusef, had already been dispatched to Fasher by Sir Herbert Kitchener with instructions to take over the administration of Darfur on behalf of the Government. Ali Dinar, however, reached Darfur before him, and lost no time in disposing of the Dervish Amir in charge of the province, of another rival claimant to the throne whom he mockingly appointed sultan of the despised blacksmiths, and finally of Ibrahim Ali himself.

" A short time later, having securely installed himself, he acknowledged the suzerainty of the Sudan Government, and in 1900 was appointed Governor-General of Darfur, subject to the payment of a nominal tribute of L.E.500 per annum. This tribute was regularly paid until after the outbreak of the European War in 1914, when Ali Dinar cast off his allegiance and refused to make any further payments. He had, as he well knew, chosen an embarrassing time to declare his independence. Turkey had just entered the war, and the Sultan of Turkey, as Khalif of Islam, had called his co-religionists to a world-wide jehad.

" Undesirous of provoking an armed conflict, the Sudan Government used every endeavour to bring the recalcitrant sultan to reason. But Ali Dinar turned a deaf ear to all counsels, and it soon became apparent that nothing but the occupation of his country would reduce him to submission.

" When the revolt was crushed the Sudan Government was faced, in the midst of the embarrassments of the European War, with the problem of bringing a newly acquired country, approximately 160,000 square miles in area, under administrative control. The whole country lies between 2,000 and 3,000 feet above sea-level, and down the centre of it zigzags a chain of rocky hills, sometimes assuming the proportion of mountains, which form the watershed of the country and part of the great watershed separating the Nile

from the basin of Lake Chad. The geological formation of these hills is varied, and has not yet been subjected to expert examination. The Jebel Meidob group appears to contain both sandstone and granite, but has been much distorted by volcanic action. Many of the hills comprising it are the craters of extinct volcanoes, and much of the country immediately surrounding it is littered with calcined rock and lava. It consists for the most part of a conglomeration of low tangled hills, but the highest peak in the central range rises to a height of about 1,200 feet above the plain."

But the difficulties which the Sudan Government had to surmount were not only geographical. They had to deal with a conglomeration of races, the main elements in which were: "(1) The Arabs; (2) the Tibbu or northern Negroid peoples; (3) the sedentary, indigenous races; (4) the immigrants from the west; (5) the immigrants from the north."

Order was eventually restored by a mobile column under the command of Lieutenant-Colonel T. B. Vandeleur (Royal Irish Regiment), which left Fasher for northern Darfur on December 18, 1916. The writer accompanied it as Political and Intelligence Officer. Early in 1917 various district headquarters and police posts were established throughout the province, and the "veritable orgy of raiding and lawlessness" carried on by the Zaghawa of northern Darfur, a "wild, dark, quarrelsome, thieving people," under the leadership of Mohammed Erbeimi, was put an end to.

The province is "well suited for stock-raising," while "excellent crops are grown in southern Darfur," and, though a geological survey has not yet been made, mineral deposits, especially as regards iron, copper, and lead, are fairly extensive.

SCIENCE AND CIVILISATION

"It is emphatically the promise of the application of science to the whole of life which is the finest feature of our age; it is the delay in fulfilling that promise which leaves our civilisation so crude and elementary. We apply science to the metals and chemicals of the soldier, even to the brains of his generals; but when it comes to studying the human conditions out of which wars arise, we leave the job to a group of utterly unscientific statesmen and diplomatists, who will consider a hundred things except what ought chiefly to be considered. We apply science to industry, and it invents machines for us which are as far beyond any mechanism known in Babylon or Athens as the Athenian loom was beyond the flint scraper of prehistoric man; but we will *not* apply science to the very greatest and gravest of all industrial problems—whether it is really necessary to keep the greater part of the race in a state of poverty and imperfect mental development and let a few monopolise its art and culture. We apply science with brilliant success to discover the evolution of mind or the evolution of morals; but we do not consult it at all when we confront the very imperfect moral condition of the world, the poor general level of character from age to age, and the chaos of contradictory opinions which is responsible.

"The old Greeks were right. The first virtue is wisdom. The uplifting of our race demands the cultivation of the heart—of fine sentiment and character—just as much as the cultivation of the mind, but the latter is more fundamental. We must know the right way before we can walk in it. That is the truth we are re-discovering. We are beginning to apply science to life. We have done with *laissez-faire*—which means, let things grow up. We are going to make them grow up. We have so bred and trained cows that they will give three thousand gallons of milk a year. There is not an element or feature of life that we cannot similarly raise to a vastly higher level. We are going to treat life as a scientific breeder treats plants. It shall all be plotted out, and its conditions scientifically studied, by a central brain. The idea of fighting it out and letting the better survive is the very opposite of science. Evolution guided by intelligence, constructive evolution, harmonious social co-operation—these are the ideals obviously thrust upon us by the very fact that intelligence now exists.

"And it is an essential condition of this further and more rapid progress that a way shall be found of putting an end to the old division of the race into a cultivated few and an uncultivated many. Democracy is inconsistent with such a situation, and is always in danger of being wrecked by it. Fine sentiment is inconsistent with it. The time is coming when men of brain will themselves devise a way out, for our age is now rapidly advancing in sentiment as well as in intelligence. When these conditions—the general and concentrated application of science to life and the elevation of the mass of the people until they can demand and watch it—are realised, the race will move on at an amazing pace. I am optimistic enough to believe that this new era, new sort of evolution, will begin in the twentieth century. And before the race lie *millions* of years during which this planet will be habitable.

"In fine, a word to the croakers who say that science may work out definite tasks, but it assigns no general goal to life. The fact is that you need no science whatever to answer that foolish question: What is the end of life? It is whatever we men may choose

to make it; and since we live in social groups, and a man's actions depend upon and influence his neighbours, it is what we choose to make it *collectively*. There is no doubt to-day about our choice. We are going to develop what is most clearly worth developing in us: intelligence, refinement, character, health. We are going to eliminate pain, unhappiness, ignorance, coarseness, violence, and poverty, as far as possible. We are going to have a hundred commonwealths, ten thousand cities, competing with each other in the realisation of this ideal. So, when the war drums beat no longer and the strong have ceased to exploit the weak, the fundamental condition of progress, mutual stimulation, will be provided on a higher plane, and the close interconnection of the whole world will make it more effective than ever."—Joseph McCabe in his book on *The Evolution of Civilisation*. (Watts & Co., 2s.)

Broadcasting by Directional Wireless[1]

By Lt.-Col. C. G. Chetwode Crawley, R.M.A., M.I.E.E.

Deputy Inspector of Wireless Telegraphy in the General Post Office

Now that the broadcasting arrangements are practically completed, it is useful to consider along what lines we may hope for future developments.

The arrangements being made, it will be remembered, provide for eight broadcasting centres in Great Britain, as it was considered that more than eight would lead to mutual interference, at any rate in the earlier stages of the experiment. This shows incidentally how very far removed we still are from the possibility of having a general scheme of wireless telephony in any way comparable to a system of line telephony. The very fact, indeed, of wireless telephony being so suitable for broadcasting means that it is unlikely that it can ever be very suitable for point-to-point communications, unless it be possible to arrange for directive working.

As a matter of fact, within the last few years great strides have been made in the technical details of this directive working, that is, in arranging for the wireless waves to be radiated, not in all directions, but as a beam like a searchlight, and for the receiving station to be affected by waves, not from all directions, but from a desired direction only. At receiving stations such arrangements have been available, when desired, for some years, but they are too expensive and complicated to be at all suitable for use by the general public. If such arrangements *were* available for receiving stations in the broadcasting scheme, the number of transmitting stations could be increased, and the listener would be able to hear any broadcasting station, which is within range, without fear of interruption. He could then choose to listen to whatever station was transmitting the sort of matter which he wanted to hear, instead of, as now, being compelled to listen to, say, Mr. Robey's latest song when he was really itching to hear Mr. Bonar Law's latest speech.

However that may be, the fact remains that apparatus for directive reception has not yet reached the stage where it can be installed without considerable expense, or manipulated without expert knowledge, but as time goes on so will these difficulties diminish, and it is easy to foresee great possibilities for broadcasting by wireless to listeners fitted with directive receivers.

In the case of directive transmission, the technical difficulties have proved to be much greater than in directive reception. Within the last year or two, however, it has been found possible to fit, at small stations, apparatus for transmitting messages in any required direction in, as it were, a wireless beam. This arrangement, when developed, will certainly be most useful for navigational purposes, as ships, or even aircraft, will be able to locate their positions by observing when they come within the beams of specified coast stations. A system of these wireless stations will, in fact, become a most useful adjunct to the present lighthouse system for navigational work near the coasts.

But so far as broadcasting is concerned, there seems little scope for directional transmission, as, after all, the chief object of a broadcasting station is to send messages, without interference from or with other stations, to as many receivers as possible, and this can best be done by using directional apparatus at the receiving end only.

[1] For a full account of "Directional Wireless," the reader is referred to an article by the same author in DISCOVERY, Vol. III, No. 26.

Some Children's Games and Songs in Ancient Greece

By W. R. Halliday, B.A., B.Litt.

Professor of Ancient History in the University of Liverpool

MOST of us at one time or another have played the uncomfortable rôle of the Complaisant Man who, Theophrastus tells us, "when asked to dinner will request the host to send for the children, and will say of them when they come in, that they are as like

their father as figs ; and will draw them towards him and kiss them and establish them at his side—playing with some of them, and himself saying : ' Wineskin, Hatchet,' and permitting them to go to sleep upon him to his anguish." [1] How *Wineskin and Hatchet* was played I do not think is known. With some games we are more fortunate. A kind of *Prisoner's Base*, which was called *Night and Day* from the names given to the two sides, is alluded to by Plato. In this a piece of pottery, black upon the one side and white upon the other, was tossed up. If white came down uppermost, Day were the catchers and Night had to get "home" before being caught. Plato, again, compares the earth to a kind of ball, the cover of which was made of twelve different-coloured pieces of leather, and a variety of ball games are described by Pollux, who gives us also the ancient Greek varieties of *Tug-of-War*, *Hide and Seek*, and *Blind Man's Buff*. Why the latter got the name of *Brazen Fly* I do not know. A child was blindfolded and turned round. He then recited, "I'm going to hunt a brazen fly," while the others beat the blindfolded "it" with strips of leather, shouting, "You will hunt but you will not catch."

The boys of Tarentum played *I Bring out the Lame Goat*, but we know only the first line of the song. The girls' game *Cheli Chelone* we may perhaps call *Torty Tortoise* ; the first word seems to be a mere nonsense reduplication of the sound of the first syllable of *chelone*. Liddell and Scott rather strangely describe it as a kind of *Hunt the Slipper*. Pollux says, "it is rather like *The Pot*." [2] One girl sits down and is called the Tortoise, while the others dance round her singing :

"Torty Tortoise, what are you doing in the middle ?"
"I am weaving wool and Milesian cloth."
"But what was your child doing, when he was lost ?"
"He jumped from his white horses into the sea."

I imagine that the last line was the prelude to some action by which a child was caught, and that *Torty Tortoise* belongs to the same genus as *Mother Mother the Pot Boils Over*, *Gipsy*, and *Old Cranny Crow*.

Milesian woollen cloth was the best in Greece, and upon its export the material prosperity of Miletus largely depended. This explains the close friendship between Miletus and Sybaris in South Italy. When Sybaris was destroyed by her rival and neighbour Croton in 510 B.C., the Milesians went into mourning. Their grief is intelligible enough when we remember that Sybaris was the depot for the Milesian trade in the Western Mediterranean. The woollen goods were landed at Sybaris, transported by land across the toe of Italy, and thence reshipped to Etruria and the markets of the West.

A singing game called *Posies* is mentioned by Athenæus. It clearly resembles *Nuts in May* and possibly *My Delight's in Tansies*, but I am not certain how the latter is played. The following verses are quoted :

"Where are my roses, where are my violets, where is my beautiful parsley ?
These are my roses, these are my violets, and this is my beautiful parsley."

Why, asks Plutarch in his Greek Questions, was there a custom amongst the Bottiæan maidens, as they danced, to sing, "Let us go to Athens" ? He answers his conundrum by reference to mythological history. Bottiæa was founded by Cretans in prehistoric times, and with the Cretan settlers came Athenians. For Athens, until Theseus slew the Minotaur, paid a yearly tribute of men and maidens to Minos, King of Crete, but these were not all given to the Minotaur, and some of the survivors took part in the Cretan colonisation of Bottiæa. Hence it is in memory of their Athenian origin that this popular song is sung. Some scholars have taken Plutarch seriously, but I do not myself believe that this yarn is earlier than the fifth century B.C., when Athens was bringing the Northern Ægean under her influence. Readers of Herodotus will be familiar with many other examples of the invention of legendary connections in prehistoric times in order to justify the pretensions of Athenian imperialism. It may quite well be that the Theseus story came into the game, for a singing game I think it pretty obviously is. We may compare—

"Lend me a pin to stick in my thumb,
To carry the lady to London town"—

which is played as far from London as Fifeshire ; or the common English game—

"How many miles to Babylon ?
Three-score and ten.
Will we be there by candle-light ?
Yes, and back again.
Open your gates and let us go through.
Not without a beck and a boo.
There's a beck and there's a boo
Open your gates and let us go through."

In the second Messenian War at the end of the seventh century B.C., Aristomenes was the heroic leader of the rebels against Spartan rule. "When Aristomenes returned to Andania the women threw ribbons and fresh flowers on him and recited in his

[1] *The Characters of Theophrastus*, translated by Jobb.

[2] *The Pot* was a boys' game. One boy in the centre held a pot on his head with his left hand, the others ran round him shouting, "Who holds the pot ?" ; the answer to which was "I, Midas." Whoever "Midas" succeeded in touching with his foot, took his place in the centre.

honour a song, which is sung to this day (our informant Pausanias is writing in the second century after Christ):

" To the midst of the Stenyclerian plain and to the top of the mountain
Aristomenes followed the Lacedæmonians."

We are reminded of 1 Samuel xviii. 7,[1] and the song may have been a popular ballad, but again I suspect a singing game. Historical events often leave their traces in nursery song. A Shropshire woman in the nineteenth century was heard to hush her baby with:

" Ring-a-ding, I heard a bird sing
The Parliament soldiers are gone for the king "—

which is a clear reference to General Monk's mission in 1660.

Where our children sing, " Rain, rain, go to Spain, Fine weather, come again," the Greek children of witch who affected the shape of a screech owl and was peculiarly addicted to sucking the blood of small children.

At weddings a song was sung about crows. There is, unfortunately, considerable doubt about the text. The reading, " Boy, drive away the crow,"[2] has been interpreted by the theory that the crow symbolises widowhood. But the crow was a bird of ill luck, and naturally its appearance at weddings would not be welcomed. I suspect that the song was merely the equivalent of the English—

" Crow, crow, get out of my sight,
Or else I'll eat your liver and light";

or the French—

" Corbeau, corbeau sauve toi
Voila le petit-fils du roi,
Qui te coupera al p'tit doigt !
Vinn vinaigre ! "

THE COMING OF SPRING.

Aristophanes' day clapped their hands and sang, " Come out, dear Sun." With—

" Lady-bird, lady-bird, fly away home,
Your house is on fire, your children all gone "—

may be compared, " Fly, beetles; a savage wolf is after you."

Greek children had also a song to " send away the strix, the crier by night, from the land, the nameless bird, upon the swift ships." The strix was a vampire-

The most famous of Greek seasonal songs is the *Swallow Song* of Rhodes. In ancient Greece as in Europe pretty generally the advent of the swallow marked the beginning of spring. In the illustration

[1] " And the women sang one to another in their play and said:
" ' Saul hath slain his thousands
And David his ten thousands.' "

[2] The first line of the song has been corrupted, from causes readily intelligible, into the jingle *ἐκκορί κορὶ κορώνην*. Bergk's reading, *ἐκκόρει, κόρη κορώνη*, " Sing the marriage song, maiden crow," gives an ill-supported meaning to the verb, and explains the " maiden crow " by a suggestion for which there is some evidence that girls were sometimes nicknamed crows. But *ἐκκόρει, κόρε, κορώνην* preserves the normal sense of the verb and is quite straightforward. Although our authorities refer to its use at weddings, I doubt if the song was necessarily restricted to those occasions.

taken from a black-figured vase the seated figure on the left is saying, "Look, a swallow." "By Heracles, so there is," says the man in the middle. "There she goes," says the third. "It is spring already." When the swallow came, the thick clothes of winter were put off and summer suits were donned. The swallow song, then, was a spring song performed by bands of boys who went from house to house making a collection.

"She has come, the swallow has come, bringing fine seasons and fine years, white on her belly, black on her back. Roll out a cake of compressed fruit from your rich house and a cup of wine and a basket of cheese. Wheaten cakes too, and bread of pulse the swallow does not reject. Are we to go or are we to get something? If you give something, well, but if not we will not go away. Either we will carry off the door or the lintel or your wife who sits within; she is small and we shall easily carry her off. And if you bring anything, bring something big. Open the door to the swallow; for we are not old men but boys." In some parts of Greece the swallow song is still performed on March 1st by boys carrying a wooden swallow on a pole. In the British Isles we may compare the *Wren Song* of Christmastide:

"The wren, the wren, the king of the birds,
St. Stephen's Day was caught in the furze;
Although he is little, his family's great.
I pray you, good landlady, give us a treat.

"My box, it would speak, if it had but a tongue,
And two or three shillings would do it no wrong.
Sing holly, sing ivy—sing ivy, sing holly,
A drop just to drink it would save melancholy.

"And if you draw it of the best
I hope your soul in Heaven may rest.
But if you draw it of the small
It won't agree with the wren-boys at all."

The Lesbian mill song is perhaps rather a genuine work-song than a singing game—

"Grind, mill, grind,
For Pittacus too grinds,
Who is king in great Mitylene."

An interesting parallel has been recorded by the late Professor Politis. A woman in Maina, the wildest part of the Peloponnese, upon whom there were billeted the police who were after her husband, who had taken to the hills, was heard to sing:

"Grind, mill, grind,
Turn out your flour fine,
Your wheaten flour crisp
That the policemen may eat,
And the sergeant, the dog,
Who is sitting in the corner."[1]

[1] Quoted Kyriakidis, *Αἱ γυναῖκες εἰς τὴν Λαογραφίαν*, p. 68.

Pittacus was a friend of Alcæus the poet, and with him a conspirator against the tyrant Myrsilus, but eventually became tyrant himself early in the sixth century B.C. His name, like that of Periander, tyrant of Corinth, was included in the list of the traditional Seven Wise Men of Greece. It is recorded of him by Diogenes Laertius that a friend came and asked him whether it was wiser to marry an aristocratic bride or one from his own station. "Go after those boys who are whipping their tops," said Pittacus, "and listen to what they say." When he got near, the friend heard one boy say to the other, "Whip the one that is by you."

To pursue the practice of divination from the chance utterances of children at play would take us too far afield. It is not uncommon. Plutarch tells us that the Egyptians drew inferences from the chance utterances of children playing in the temples; the hearing of a boy's voice, which repeated, "Take up and read," was a factor in the conversion of St. Augustine; the deductions to be drawn from children's play are given in a German pamphlet of popular divination belonging to the sixteenth century, and an interesting account drawn from an eyewitness, the author's grandfather, is given by the Turkish traveller Evliyá Efendi, of how the play of the seven sons of Sultan Ahmed I (1603–1617) foretold their respective destinies and the conquest of Crete by Sultan Ibrahim.[2]

The text of the Greek songs will be found collected in Bergk, *Poetæ Lyrici Græci*, vol. iii, and a description of the English games mentioned in Lady Gomme, *The Traditional Games of England, Scotland, and Ireland*; some of the explanations of their origins there given may perhaps be taken with a grain of salt. For the bird songs see Swainson, *The Folklore of British Birds*. The text of modern Greek swallow songs is given in Passow, *Carmina Popularia Græciæ Recentioris*, Nos. 305–9. The illustration is after Baumeister, *Denkmäler, des Alterthums*, III, Fig. 2128; it is also figured in Miss Harrison, *Themis*, p. 98. The current number of the *Journal of Hellenic Studies*, vol. xlii, contains reproductions of the very interesting reliefs of the sixth century B.C. which were discovered in Athens this year. One of the scenes depicted can only be described as a game of hockey!

THE ANTIQUITY OF MAN IN AMERICA

In the articles on "The Antiquity of Man in America" which appeared in our October and November numbers, the author, referring to the discovery of a tooth in the early Pliocene beds of Nebraska, impressed upon his readers the necessity for caution and careful deliberation before accepting the identification of this tooth as the molar of an ape-like man of a type earlier than any hitherto discovered. It is, therefore, interesting to note that this identification was called into question at a meeting of the Zoological Society of London held on November 7, when photographs and a cast of the tooth were exhibited by Prof. Elliot Smith. After a careful examination of the characters of the tooth, one by one, and of the pulp

[*Continued at foot of page 330.*

[2] Von Hammer, *The Travels of Evliyá Efendi II*, pp. 85–8.

The Movements of the Planets

By H. Spencer Toy, B.Sc., A.Inst.P., F.R.A.S.

THE whole system of the stars appears to move across the sky from east to west every twenty-four hours. This is due to the rotation of the earth on its axis once a day. Of this motion we need not think in this article, since the sky seems to move as a whole.

The sun and moon have a second motion that is easily observed, for they move among the stars from west to east. Thus, for instance, if the moon is near the Pleiades one night, it will be some distance from them on the next.

Both solar and lunar motions are continuous towards the east. But the planets move among the stars in no such simple way, although on the whole

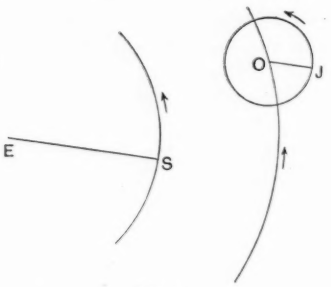

FIG. 1.

they also appear to travel towards the east. It will be convenient to consider them in two groups: those that lie beyond the orbit of the earth, and those that are within.

By those beyond the orbit of the earth we mean Mars, Jupiter, and Saturn, for Uranus and Neptune are not visible to the naked eye. Their apparent motion can roughly be described as a progression in loops. For the greater part of the time they move from west to east, just as do the moon and the sun; then they stop altogether at a so-called "stationary point," move backwards or "retrograde," become stationary again, and then advance towards the next loop.

The loop takes several weeks to make, and can be followed in the sky by comparing the positions of the planet night by night with those of the fixed stars. It is easy to follow this changing configuration when it takes place in a conspicuous constellation, such as Taurus, but it is not very difficult even when it occurs in a barren one, like Cancer. This year Jupiter, for example, made its loop in Virgo, and was therefore very easily followed. Whilst there are many celestial phenomena that most people can never hope to see, among which may be included a total eclipse of the sun, from the town in which they live, and a transit of Venus, this looping the loop occurs so frequently and is so obvious that it may be seen by all. Yet it is improbable that one person in ten, or even one in fifty, ever sees it! It excites no attention in the Press, it gives rise to no great sensation as might a comet or a shower of meteors, and the loops are made unnoticed.

Jupiter traces out a loop once in every 399 days, a trifle over thirteen months, and eleven loops are made as it revolves completely round the circle of the sky in nearly twelve years. In twelve years' time, therefore, Jupiter will again be looping its loop in or near Virgo. Saturn makes a smaller loop once in 378 days, a year and a fortnight, and completes twenty-eight of them in its journey round the heavens. The loops of Mars are much bigger than either of those already mentioned, but occur less frequently, only once in 780 days, nearly two years and two months. This planet retrogrades for 70 of the 780 days, the corresponding period in the case of Jupiter being 123 days, and in the case of Saturn 137 days.

This loop-like movement was observed from prehistoric times, and its explanation exercised the ingenuity of all the ancient astronomers. They started with two fundamental assumptions, both of which were incorrect. The first was that the earth was fixed in space, and was the centre of the universe; round it the stars revolved. The second was that the circle was the perfect figure, just as seven was the perfect number, and that the planets, being celestial bodies, could therefore move only in circles. With these ideas as his foundation, Ptolemy elaborated a system to explain the movements of the planets, and a very ingenious one it was. It was constructed at Alexandria about A.D. 140, and set out in the famous *Almagest*, which remained for fourteen hundred years the standard work on astronomy. Reference was made to it whenever a dispute arose, and by it all questions about the stars were settled, just as all questions on religion were settled by reference to the Koran.

Ptolemy imagined the sun to revolve round the earth in a simple circle once a year. The planets, on the other hand, revolved round a small circle, which itself went round the earth. In the diagram (Fig. 1), let E represent the earth, S the sun, and J an outer planet, say Jupiter. Jupiter was supposed to revolve round the small circle, centre O, and O itself to go round the earth in the period of twelve years, which has already been explained to be that which Jupiter takes to make the circle of the skies. The small

circle with centre O was named an "epicycle," and the bigger circle upon which O travelled was known as the "deferent." It was further laid down that the line joining O and J must rotate at such a speed

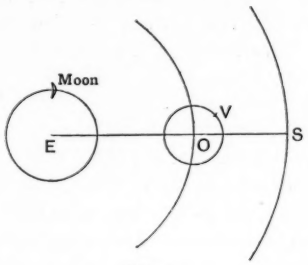

FIG. 2.

as to remain always parallel to the line joining E and S, so that J went round O once every time that S went round E, that is, once a year. It is evident that such an arrangement will give rise to the loop-like motion, the forward movement being obtained when J is outside the deferent, the backward when it is inside.

This explanation holds for Mars, Jupiter, and Saturn, which the ancients regarded as being outside the orbit of the sun. The case of Mercury and Venus, however, is somewhat different. These bodies were recognised to lie between the earth and the sun, and to explain the observed fact that they were never seen very far from the latter, never, for instance, being in opposition, Ptolemy said that the line OV need not be parallel to ES—the condition laid down in the case of the outer planets—but that, instead of it, the centre of the Venusian epicycle, O, must always lie on the line ES (see Fig. 2). Precisely the same explanation applied to Mercury, and the Ptolemaic system is completed when we add that the moon was supposed to revolve round the stationary earth in a simple circle.

The origination and building up of such a system was a veritable triumph of the human mind. Ptolemy's scheme, indeed, was far more ingenious and complex than the simple arrangement of Nature. This is not infrequently the case with human hypotheses, for Nature is at once immensely great and intensely simple. In the early days of astronomy the Ptolemaic explanation of the movements of the planets fitted very well with what could be observed and with the measurements that had been made. But as time went on and observation became more accurate, slight irregularities were noticed that could not be explained by the epicycle rotation. The original theory was therefore modified; it was stated that the earth was not quite at the centre of the concentric circles, nor was O quite at the centre of the epicycle. Thus the circles were now eccentric, and the movements were eccentric, precisely the same kind of thing as may be seen in that part of an engine to which we give the name "eccentric." The Ptolemaic system, thus adjusted, accounted for what could then be measured, but observations were always becoming more exact and further irregularities were always being detected. To meet these new difficulties, the Arabian astronomers introduced new epicycles, and superposed them on the old ones, and kept on adding more and more until the system became exceedingly complicated and absolutely out of harmony with the fundamental simplicity of Nature.

A humorous story is told of King Alphonso of Spain in this connection. He had given orders that tables should be compiled to show the motions of the planets. When the astronomers had finished their work and had taken the tables to the King, they looked so very complex that the monarch is reported to have said, "I wish I had been present at the Creation, I would have given some good advice."

A great change came over the spirit of science with the Renaissance at the beginning of the sixteenth century, and a corresponding change was seen in its statements and results. The ideas of Ptolemy that had flourished so long were rejected altogether by Copernicus, who showed that the complicated explanation involving epicycles and deferents was quite unnecessary, and that for it there could be substituted

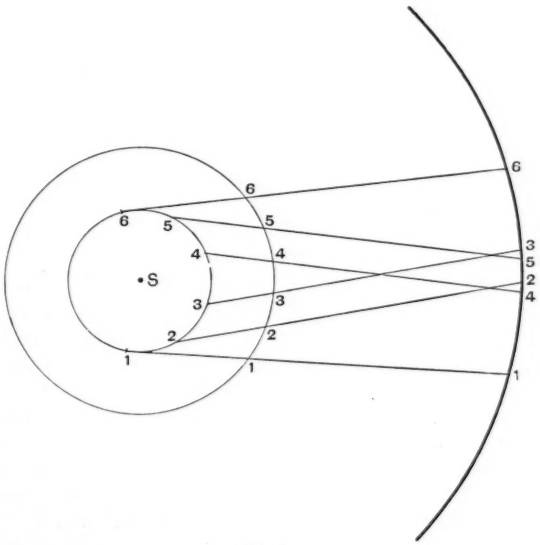

FIG. 3.

a much simpler one, if it were assumed that the planets went round the sun and that the earth rotated on its axis once a day. These two assumptions completely revolutionised astronomy and laid the

foundations for the great modern advances. Yet even Copernicus was not entirely free from the influence of ancient superstition. He kept the perfect curve, the circle, for his planetary orbits, but he stated that the sun was displaced very slightly from the centre; he also accounted for a few irregularities by retaining one or two epicycles. With the exception of these minor points, however, the Copernican system was much the same as the one we now adopt. Kepler completed the work of his great predecessor some sixty-five years later by showing that the paths of the planets are ellipses, but ellipses that do not depart very greatly from the circular form.

Let us now pass on to consider how the loops in the planetary paths can be explained. Suppose the inmost circle represents the orbit of the earth (Fig. 3), and the next one that of one of the outer planets, say Mars. Let the outer circle, shown in part, represent

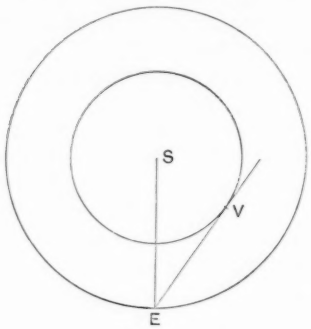

Fig. 4.

the background of the sky, and let S be the sun. At equal intervals of time the earth will be at points marked 1, 2, 3, 4, 5, 6, spaced out equally on its path. At the same time Mars will be at corresponding points on its orbit, marked 1 to 6 on the larger circle. When the earth and Mars are at their points 1, Mars will appear to us to be at the corresponding point 1 on the sky-circle. Similarly for all the other points. The diagram shows us that we get a forward movement from 1 to 3, followed by a backward from 3 to 4, and then a forward from 4 to 6, and onwards until the next loop is commenced. If we imagine the circles as lying slightly out of the plane of the paper, and inclined to it at different angles, the path traced out becomes a loop.

The outer planets always appear brightest when they are in the middle of the backward portion of the loop, for then they are always in a line with the earth and the sun, or exactly opposite the sun as seen by us—a configuration to which we give the technical name "opposition." Their brilliancy varies considerably at different oppositions. In the case of the earth and Mars the orbits are comparatively near each other at one part, and are much farther away at other parts. When an opposition takes place with the planets at the former points, Mars is nearer the earth than it is at any other time, and so appears much brighter. But if the opposition takes place with the earth and Mars at some of the latter points, the distance is so much greater that the maximum brilliancy of the planet is far less than it was in the previous case.

This variation of brightness is more marked in the case of Mars than in that of any other planet. The best possible oppositions are those that occur at the end of August, when the planet loops its loop under the Great Square of Pegasus. These maximum oppositions happen once in about fifteen or seventeen years; the last was in 1907, and the next will be in 1924, and will be absolutely the most favourable for the two centuries 1800–1999. The planet will then be only 34,650,000 miles from the earth.

The variation in the case of Jupiter is not nearly so much. For this planet the most favourable oppositions occur about October 6, when Jupiter is 369,000,000 miles away. The least favourable are those that take place in April, when the distance is increased to 411,000,000 miles. The other visible outer planet, Saturn, is so far away that the variation in its brilliancy is not at all a conspicuous feature of its oppositions; its brightness is, in fact, controlled by the inclination of the ring system.

A few words will probably suffice to explain the apparent movements of the inner planets, Mercury and Venus. It will be evident from the figure that they can never rise at sunset and remain visible all through the night as do those that lie beyond the orbit of the earth. They appear to vibrate, swinging from side to side of the sun. If the inner circle (Fig. 4) represents the orbit of Venus and the outer that of the earth, it is obvious that the greatest apparent distance of Venus from the sun is given when the line EV, joining the two planets, is a tangent to the orbit of Venus. This planet is visible for some months when it is coming into, or receding from, this position. Mercury, however, is visible to the naked eye for only a few days each year, when it appears like a white or silvery point flashing in the afterglow of sunset or just before the dawn.

Continued from page 327.]
cavities as shown in X-ray photographs, Prof. Elliot Smith is inclined to agree that it affords evidence of the existence of a primate, in some respects like the chimpanzee, but definitely human rather than ape-like and representing a type of the human race older than *Pithecanthropus* of Java. Dr. Smith Woodward, however, adhered to the opinion he had previously expressed that it was more likely to belong to the genus of extinct primitive bears known as *Hyænarctus*, and claimed that it was more like the upper molar of a carnivore than of a primate.

Reviews of Books

Age and Area. A Study in Geographical Distribution and Origin of Species. By Dr. J. C. Willis, F.R.S. With chapters by Hugo De Vries, H. B. Guppy, Mrs. E. M. Reid, and Dr. J. Small. (Cambridge University Press, 14*s.*)

The geographical distribution of plants over the earth's surface has long occupied the attention of naturalists, but it was Darwin's treatment of the subject in the *Origin of Species* which initiated a more scientific study of plant geography. "In considering the distribution of organic beings over the face of the globe," he wrote, "the first great fact which strikes us is, that neither the similarity nor the dissimilarity of the inhabitants of various regions can be accounted for by climatal and other physical conditions." Darwin held that every species began its existence at some one place, whence it gradually spread. Some species were successful travellers, while others lagged behind and never occupied more than a restricted area. The idea of multiple origins, that is, that the same species may have been created independently at more than one place, was superseded in the minds of most naturalists by that of single centres of creation. As Darwin said, "The simplicity of the view that each species was first produced within a single region captivates the mind." He also wrote: "As many more individuals of each species are born than can possibly survive; and as, consequently, there is a frequently recurring struggle for existence, it follows that any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving, and thus be naturally selected. The preservation of favourable varieties, and the rejection of injurious varieties, I call Natural Selection."

The doctrine of natural selection in Darwin's mind was intimately connected with geographical distribution. Dr. Willis, as he tells us in the Preface, was formerly a "pupil of the strictest school of Natural Selection"; but, he adds, a course of "independent observation of nature," extending over several years, led him to shake off the trammels of the theory and compelled him to profess his belief that "Age as an explanation of spread is enormously simpler than natural selection." An analysis of the flora of Ceylon and, subsequently, of the floras of other countries, led to the enunciation of the hypothesis which is conveniently spoken of as Age and Area. In the volume before us Dr. Willis summarises and amplifies views previously published in various scientific journals. It is impossible in a short review to deal adequately with the many interesting problems raised by the author; one can only draw attention to the salient features of the hypothesis and offer a few criticisms.

In Part I he deals with the present position of Age and Area. In the introductory chapter he writes: "For sixty years we have been under the wonderful fascination of the theory of evolution by means of infinitesimal variations, or minute changes of character from individual to individual." So far as I am aware, Darwin never speaks of variations as "infinitesimal." Seeing that Dr. Willis is a confirmed unbeliever in Natural Selection, it would have been better to quote Darwin's words and thus make clear the precise meaning which Darwin attached to that expression. Willis adds that the distribution of any species is governed by the interaction of many factors and physical barriers; but while the various factors will be likely to act with some uniformity only on a group of allied species, age pulls all alike. The area occupied is largely the result of age: widely spread species are older than species confined to a small area. It is true that a recently evolved plant or animal has had insufficient time to travel far from its original home; but it is equally true that many plants and animals of restricted range formerly occupied a larger territory. In other words, size of area is not a safe criterion of age. To get to the bottom of the history of organisms, we must consider the evidence of the rocks and take into account distribution in the past as well as in the present. The study of fossil plants shows unmistakably that many genera that are now confined within narrow geographical limits are survivals, and not young beginners. Dr. Willis admits that there are exceptions to his general rule; but he considers their number insignificant. "Another popular theory," he says, "about localised species like these Ceylon endemics [species, genera, or other groups confined to a small area] is still strongly held . . . it is to the effect that species on very small areas are really in process of dying out. This hypothesis is supposed to be supported by the facts of fossil botany, which unquestionably proves that many species have existed in the past and no longer occur in the world to-day." The point is, not that fossil botany proves the former existence of species no longer represented in present-day floras—a fact universally admitted—but that it is no mere supposition that it also teaches us that many genera of plants now confined to small areas are very old types and in former ages had a wide distribution. There are many, not few, such genera. He deprecates conclusions based on individuals; groups of ten species at least must be considered. But all facts must be taken into account in our endeavour to discover the truth.

Chapters are included on the dispersal of plants into new areas; the introduction and spread of foreign species; acclimatisation; and other subjects. Part II is devoted to the application of Age and Area to the flora of the world, and its implications. In 1912 the author noticed that of the 1,028 genera in the flora of Ceylon, there are 573 genera with one species each, 176 with two species, 85 with three species, and so on. These numbers clearly show that genera with one and two species are much more numerous than genera with more species. An analysis of floras of many, both large and small, regions revealed the same state of affairs. If the genera of different floras are arranged according to the number of species they contain and the arrangement is expressed by curves, these exhibit a striking uniformity. The same type of "hollow curve" was obtained by treating

animal populations in the same way. In any country, and on the average, the larger families and genera, Dr. Willis says, will be the older, and will occupy the larger territory. To the idea of Age and Area he adds that of Size and Space. If groups of allied genera be dealt with, the size of a genus (i.e. the number of species it includes) is found to depend largely upon the area it covers, that is, "ultimately upon its age." The author's position is that natural selection no longer concerns us; there is a mechanical explanation of the facts of distribution. Age supplies a measure of distribution. The uniformity of the curves must be explained; there is clearly something underlying it. The question is, has Dr. Willis found the correct explanation?

He has written a stimulating book; it is not all easy reading, and one feels a suspicion that the author, carried away by his enthusiasm, did not allow himself enough time for critical revision of the manuscript. He has stated his case; and it is for those who disagree with the conclusions to state theirs. That Dr. Willis has rendered a valuable service to biological science the great majority of his readers will concede; he has directed attention to a subject which has suffered neglect, and in support of his thesis he has marshalled an imposing array of facts. The Age and Area hypothesis is simple; but I venture to think that it does not furnish a solution of the problem of geographical distribution considered in its broader aspects.

A. C. SEWARD.

Elements of Plant Biology. By A. G. TANSLEY, M.A., F.R.S. (George Allen & Unwin, Ltd., 10s.)

"This book is intended," the author states in the Preface, "primarily for medical students and others who do not necessarily intend to continue the study of Botany, but who desire or are obliged to obtain some elementary knowledge of plants, particularly in relation to general biology." In a recent number of DISCOVERY, a book by Professor Dixon, on lines very similar to those followed by Mr. Tansley, was briefly reviewed. The two books have much in common; both are primarily intended for medical students; both break away from the more formal method, that used to be in fashion, of studying types rather from the morphological (that is, the aspect of biology concerned with form and structure) than from the physiological point of view; and both include admirable guides to practical work.

Mr. Tansley begins with a scholarly treatment of certain subjects of fundamental biological importance: the differences between plants and animals, organic substances and their chemical characters, some physical characters of organic substances, protoplasm and the *Amœba*, the vital functions, the cell. The suggestion may be offered that these more difficult subjects would come better after some account had been given of a typical green plant. It is easier to interest the beginner in the materials of which a plant is built after he has been introduced to the main features of a plant as a living organism—a complex and efficient machine—than to begin by descriptions of the nature of the materials of which organisms are constructed.

The main divisions of the plant-kingdom are then passed in review and illustrated by good descriptions of well-chosen examples: the lower plants are dealt with first, an order that is both logical and most likely to awaken the interest of students. Throughout the book the wider aspects of biology are kept in view, and frequent and apposite comparisons are made between plants and animals, both from the standpoint of construction in relation to manner of life and from the point of view of nutrition. Stress is laid upon subjects which may reasonably be regarded as essential parts of the equipment of a medical student, subjects which, indeed, should be included in any scheme of liberal education.

The book is clearly written and adequately illustrated: the presentation of the subject is characterised by accuracy and a philosophical outlook. It is probable that some beginners will find certain parts rather difficult, especially the chapter on "Some Physical Characters of Organic Substances"; but this surmise may be, and probably is, largely due to the fact that many of the older botanists—among which the reviewer includes himself—received their training in the days when text-books of botany did not deal with such subjects as surface tension, surface energy, adsorption, colloids, and other phenomena, the importance of which in biology has only been recognised in comparatively recent times.

The most difficult art is to know what to omit; it is arguable that certain plants excluded by the author might, with advantage, have been included in place of some of those selected for treatment; but whether or not Mr. Tansley has made the best choice, the important point is that he has produced an admirable textbook, which may be strongly recommended not only to students in the narrower sense, but to all who wish to learn something of the mysteries of life and of the nature of the problems suggested by the word "evolution." One is sometimes asked to believe that it is superfluous for medical students to be expected to acquire a knowledge of botany. By his treatment of plant biology Mr. Tansley has supplied a very powerful argument in favour of the retention of botany in the medical curriculum, and has demonstrated the possibility of treating the subject on broad lines and making clear to any intelligent reader the position of plants in the general scheme of living beings.

A. C. S.

Secret Sects of Syria and the Lebanon. A Consideration of their Origin, Creeds, and Religious Ceremonies, and their Connection with and Influence upon Modern Freemasonry. By BERNARD H. SPRINGETT. (George Allen & Unwin, Ltd., 12s. 6d.)

Several attempts have been made to connect the Masonic order with the mystic religions of the East; but they have not commended themselves to the majority of members of the Craft. Dr. Churchward, in his *Arcana*

of Freemasonry, endeavours to show that Masonic ritual can be traced back to early prehistoric times. Although Mr. Springett's aim is more restricted, his book links on to Dr. Churchward's work in that he suggests a connection between the cults which he here brings under review with sun and stellar worship through the religions of ancient Egypt and Mesopotamia. The scope of the book is wider than the title indicates; it covers not merely the sects of Syria, such as the Nusairi and Druses, but deals with most of the mystic religions of Western Asia, the Eleusinian mysteries, Mithraism and Gnosticism, as well as with Mohammedanism and its principal sects, Shia, Sufi, Ismaeli, and the like.

It may be noted in passing that the author has no first-hand knowledge of this part of his subject, but merely summarises from his particular point of view the accounts of other writers, not all of whom would now be regarded as authoritative.

Mr. Springett's theory is that the present ritual of Freemasonry is derived from the European continuations of the ancient mysteries, and, in particular, from the Manichæan doctrines perpetuated by the Crusaders. The tradition, he holds, was carried on by bodies founded by the last Grand Prior of the Knights Templar when that order was suppressed. The connection between the rites of Freemasonry and the heretical beliefs of the Templars has been suggested before. It is doubtful how far the Templars did hold the beliefs attributed to them. The author relies upon the charges brought against them at the time of their suppression; but the evidence would not now be held to be conclusive, and confession under torture is not proof. Mr. Springett suggests that the Templars had modelled their organisation on that of the Assassins, the Ismaeli who followed the "Old Man of the Mountains." Although the Crusaders were in close touch with the Western branch of the Assassins, and were, on at least one occasion, in alliance with them, the resemblances in the two organisations are merely superficial. As no note was made of the contents of the records of the Assassins until after their destruction by the Mongols, our knowledge of their tenets and organisation is not necessarily accurate—a fact which may account for some of their remarkably peculiar features.

It cannot be said that Mr. Springett has proved his case: where he sees identity his readers will probably see little more than an interesting similarity. Throughout connection is assumed rather than demonstrated. The author's lack of archæological knowledge has led him to formulate theories which will not bear critical examination, and to accept the conclusions or dogmatic statements of others which can no longer be maintained. Druids and Phœnicians are called upon to play a part in support of theory to which we have ceased to be accustomed. In minor details the author has not escaped error; the Pole star is not in Ursa Major, and it is to be presumed that, in alluding to the decipherment of the Babylonian and Assyrian tablets, the author really intended to refer to the Behistûn inscription, and not, as he does, to the Rosetta Stone.

E. N. FALLAIZE.

Books Received

(Mention in this column does not preclude a review.)

MISCELLANEOUS

Secret Sects of Syria and the Lebanon. By BERNARD H. SPRINGETT, P.M., P.Z. (George Allen & Unwin, Ltd., 12*s.* 6*d.*)

The Supremacy of Spirit. By C. A. RICHARDSON, M.A. (Kegan Paul, Trench, Trübner & Co., Ltd., 5*s.*)

Among the Head Hunters of Formosa. By JANET B. MONTGOMERY MCGOVERN, B.L. With a Preface by R. R. Marett, M.A., D.Sc. Illustrated. (T. Fisher-Unwin, 15*s.*)

Stories from the Early World. By R. M. FLEMING. With an Appendix by Prof. H. J. Fleure, D.Sc. (Benn Bros., Ltd., 15*s.*)

At Home with Wild Nature. By RICHARD KEARTON, F.Z.S. Profusely illustrated. (Cassell & Co., Ltd., 7*s.* 6*d.*)

PSYCHOLOGY

Beyond the Pleasure Principle. By SIGMUND FREUD, M.D., LL.D. (The International Psycho-analytical Press and George Allen & Unwin, Ltd., 6*s.*)

Studies in Psycho-analysis. By PROF. C. BAUDOUIN. Translated by E. and C. Paul. (George Allen & Unwin, Ltd., 12*s.* 6*d.*)

Remembering and Forgetting. By PROF. T. H. PEAR, M.A., B.Sc. (Methuen & Co., Ltd., 7*s.* 6*d.*)

SCIENCE

The Principle of Relativity, with Applications to Physical Science. By A. N. WHITEHEAD, Sc.D., F.R.S. (Cambridge University Press, 10*s.* 6*d.*)

These lectures expound an alternative rendering of the theory of relativity. The book is divided into three parts. Part I is concerned with general principles and is mainly philosophical in character; Part II is devoted to physical applications; Part III is an exposition of the elementary theory of tensors. No part of the book is easy reading; it is not another popular book on relativity —Einstein diluted at Aldgate pump; it is indeed for students of the most serious class only. To appreciate Dr. Whitehead's arguments and points completely a reader must be philosopher, physicist, and mathematician in one, and few there be who are such.

The Manufacture of Dyes. By JOHN CANNELL CAIN, D.Sc. (Macmillan & Co., Ltd., 12*s.* 6*d.*)

A posthumous work, edited by Dr. J. F. Thorpe, intended as a supplement to an earlier volume, *The Manufacture of Intermediate Products for Dyes*, and one of the first compilations in English of the methods actually used in making dyes.

Inorganic Chemistry. A Textbook for Schools. By E. J. HOLMYARD, B.A. (Edward Arnold & Co., 6*s.* 6*d.*)

A book for candidates for the School and Higher Certificate, by the head of the science department at Clifton College, up-to-date, well-arranged and carefully written. The physical chemical side of the subject is well done, and the sections on the structure of atoms and molecules and on the Arabs' contribution to mediæval chemistry are excellent.

An Introduction to Forecasting Weather. By P. RAYMOND ZEALLEY, F.R. Met. Soc. (Cambridge: Heffer, 1*s.*)

The Microscope. A Practical Handbook. By LEWIS WRIGHT. Enlarged and revised by A. H. Drew, D.Sc., F.R.M.S. (Religious Tract Society, 5*s.*)

Radio for Everybody. By AUSTIN C. LESCARBOUX. Edited by R. L. Smith-Rose, M.Sc., D.I.C. (Methuen & Co., Ltd., 7*s.* 6*d.*)

General Astronomy. By H. SPENCER JONES, M.A., B.Sc. (Edward Arnold & Co., 21*s.*)

A Second Course in Engineering Science. By P. J. HALER, M.B.E., B.Sc., and A. H. STUART, B.Sc., F.R.A.S. (University Tutorial Press, 5*s.*)

Correspondence

SECONDARY SEXUAL CHARACTERISTICS

To the Editor of DISCOVERY

SIR,

Dr. Mottram's letter in your October number raises a number of interesting points, to some of which I will attempt to reply here. In the first place, I must plead guilty (p. 201, l. 17), under the exigencies of space, to attaching undue emphasis to the necessity for stimulation of the female by the male. When "courtship" occurs, this is its *usual* form; but the reverse occurs, e.g. in Phalaropes, and comparatively often there is *mutual* stimulation.

This brings me to Dr. Mottram's specific criticism. He points out that many birds are alike in both sexes. On the other hand, he fails to distinguish cases in which the sexes are alike but protectively coloured, from those where they are alike but brilliantly coloured and often possessed of special adornments; he further fails to distinguish between those in which, although the sexes are alike, the males alone perform "courtship" actions (e.g., most Warblers), and those in which "courtship" is a mutual affair—both sexes playing similar rôles (e.g. Herons, Grebes, Divers, Fulmars, etc.).

As a matter of fact I have published (*Proc. Zool. Soc.*, 1915) an account of the sexual ceremonies of the Crested Grebe, where (and in the *Auk* 1916, and in *Nature* 1921) the matter is discussed, and it is made, I think, clear that such "mutual courtship" may lead to the development of bright colours and special structures in *both sexes* simultaneously.

I have since then investigated the courtship of Divers, Egrets, and other birds, and have a paper in press for the *Proc. Linnean Soc.*, to which I must refer Dr. Mottram for a full theoretical discussion of the very interesting questions he raises as to protective coloration and the similarity of the two sexes, together with numerous other points.

I am grateful to him for having pointed out the error in my presentation. I should have said something like this: "As mind develops, new complications arise. Emotional stimulation is often necessary before sexual union can be consummated. Largely from this cause there have arisen the ceremonies and displays of courting animals."

On the other hand, his criticism seems to me to be based on a rather extensive lack of acquaintance with the actual facts of "courtship" (to use that unsatisfactory but generally-accepted term). No one who has not studied in detail the actual occurrences associated with display and other sexual ceremonies in birds can have an idea of their complexity, or a right to indulge in *a priori* theorising on the subject. I can at least claim that the conclusions which I have reached—for a detailed presentation of which, I repeat, I must refer Dr. Mottram to my forthcoming paper—are based on careful field study reinforced by over ten years' thinking and digging into the literature.

There are a great many complicating factors; but there is absolutely no doubt in my mind that there does exist a relation between (1) a certain level of mental organisation; (2) the performance of so-called courtship ceremonies by one or both sexes; (3) the acquisition of bright colours, special structures, or stimulating qualities of voice or odour, in *one or both sexes*.

These characters developed in relation to courtship can best be called by Poulton's term *epigamic*, as their function is subsidiary to the union of male and female sexual cells.

It is an extraordinary thing how little work has been done on a study of sexual ceremonies, even in common British birds. For instance, until Eliot Howard's monumental *British Warblers* appeared, in 1907 to 1914, no satisfactory description, much less interpretation, had ever been given of the relations of the sexes in any single species of the group!

Anyone who is fond of natural history, has plenty of patience, a field-glass and a notebook, and does not mind now and again getting up early in the morning, can contribute valuable material to this branch of science and to the theory of sexual selection. The story even of the Robin is not properly known! The Tits, the Woodpeckers, the Waders, the Wagtails, the Kingfisher—comparatively little has been discovered about the sexual relationships of these groups, to name but a few as they come into my mind.

I cannot better close this letter than by appealing to the amateur ornithologist, not merely to collect records

of birds like so many stamps, nor even only photographs of birds, but to have a definite problem in his mind which he can solve by persistent watching, by penetrating into the secrets of the birds' intimate life.

Yours, etc.,
JULIAN S. HUXLEY.

NEW COLLEGE,
OXFORD.
October 14, 1922.

THE PROBLEM OF PERSONALITY

To the Editor of DISCOVERY

SIR,

I have read with much interest Mr. J. S. Huxley's letter on this subject, and agree with him that personality cannot be a thing independent of the organic structure and physiological life of the person. There are, however, some important aspects of natural personality which he does not deny, but fails to note ; and on these I should like to be allowed to say a few words.

An individual organism cannot be regarded as a mere product or passive outcome of the two factors, heredity and environment. Each organism is *itself*, being a unique centre of relations, both to its progenitors and possible descendants, and to its presently-conditioning surroundings—to the ground and air (or water) and plants and animals in the particular terrestrial place or series of places in which it lives, and to the particular portions of food which it assimilates. Even a pebble, though devoid of life and growth, is *itself*. It is not any *other* pebble which may happen to be its exact counterpart in shape and substance. Nor is it wholly a product of antecedent and external forces. Its own substance is a small part of what was the substance of its parent rock, but the form which it acquired in breaking away therefrom gives it a separate identity, and, if it has since been rounded and polished by the action of the waves, its own substance and its own original form were both necessary conditions of what it has now become. The formation of a pebble through essentially disintegrative forces is, of course, a process very different from the regular integrative development of an organism ; but I suggest that the *selfhood* of each living organism cannot be something less, and is, in fact, something much more, than the selfhood of each pebble. The organism is not a thing made by abstract conditions called " heredity " and " environment," but a thing which makes itself in accordance with certain hereditary tendencies and with the external means which it finds for their exercise.

While the above would be true of an individual plant, it is only in the case of animals, with their nervous systems and powers of contingent activity, that selfhood appears to be dimly *felt*, and only in the case of human beings that it comes to be *clearly reflected upon*. It is, I suggest, with the reflective knowledge of selfhood that what is properly called " personality " arises. A scientific induction associates personality and personal consciousness with a part of the brain and nervous system but the person's " common sense " has previously associated them with the sensitive skin-envelope, the eyes in looking, the ears in hearing, the voice in speaking, and with all voluntary muscular actions, and has, at the same time, contrasted these outward instruments of personality with the inner stream of perception, thoughts, emotions, desires, and decisions.

Personality differs from actual consciousness, or presently-passing experience, in that it involves permanent aptitudes for perceiving, thinking, feeling, and willing in a great variety of different ways, according to the particular situations presented to our senses or the particular thoughts evoked by listening to speech, reading, writing, or meditating. Very little of all that we are accustomed to perceive or do or think or feel can be simultaneously presented to consciousness ; and hence our knowledge of our own personalities, like that of our inner bodily organisms, is mostly indirect. In actual consciousness the awareness of personality seems to consist in a general sense of one's personal powers connected with some memory of one's past experiences. This awareness, absent in sound sleep, is curiously travestied in dreams, while personality itself is perverted in the mental aberrations of the insane, some of whom seem to have dual personalities.

As an aspect of the whole person, personality is the mental and morally social, not the physical and physiological aspect. It is the person's character—his distinctive type of human nature—in which the instincts derived from animal or low human ancestry are more or less controlled or sublimated by ideas and ideals, beliefs and reasonings, due to educative influences and personal reflection, and constituting personal intelligence. Only at its best does such intelligence approximate to true reason. True reason is not egocentric, but actuated by the objective interests of careful observation and clear thinking and allied to human sympathy and the sense of justice, which are, together with it, the conditions of personality developing on other than merely selfish lines.

Mr. J. S. Huxley says that environmental factors " undoubtedly play a relatively small part in forming personality compared with those which are hereditarily determined." Here I cannot agree with him, as I think that the normal human brain must be made by the evolving individual life (not *wholly* on ancestral lines), that it is an extremely plastic instrument, and that most of what a civilised human being *is* is derived from the social culture-heritage, the elements of which are imparted to him by education and the personal influences of those with whom he comes in contact from childhood upwards. This fact, if it be such, cuts both ways, ethically speaking. Many of the traditional beliefs on which so-called civilised people are taught to conduct their lives are as pernicious as are any of the primitve instincts derived from their savage or barbarian ancestors, and may indeed afford shelter and excuse for such instincts. On the other hand, there is hope that mankind's wisdom will increase, as genuine knowledge, based on observation, experiment, research, and reflection, is made widely accessible, and especially as the habit of sincere personal thinking—

a most important factor in shaping adult personality—is widely stimulated.

Yours, etc.,
CHARLES E. HOOPER.

SOUTHAMPTON.
August 13, 1922.

To the Editor of DISCOVERY

SIR,

For many years I shared the difficulty which Mr. Rogers mentions in his letter. The confusion that arises in the mind when one tries to understand psychological terminology is most embarrassing. I gave up the chase of the meanings of the words as shown in literature and went direct to the source whence the word arose. On that I settled the meanings for myself, and I have never had to retrace my steps. There are three words which occur continually and are used interchangeably by nearly all writers, just as if one had the same meaning as the others. Therein the difficulty arises, and not in the meanings of the words themselves. The words are Personality, Individuality, Spirit. They all refer to the human being.

As I understand it, Personality comes from *Persona*, which means a mask or covering, and is used in many senses, such as *Dramatis Personæ*, in which the actor is disguised by his garb. In psychology or metaphysics it would mean the body which covers the spirit or actor beneath it. Individuality comes from *Individuus*, which means that which cannot be divided. It cannot refer to the body, for that can be divided into parts. It must refer to something immaterial, and that something, I think, is the mind, which is indivisible and one, and is the result of the combination of the spirit and the body.

Spirit comes from *Spiro*, which means breath or motion or movement, and is immaterial also. It is the power which makes all movement of the body, whether it be conscious or involuntary.

If these basic definitions are adhered to they will explain the whole subject. In practical work I have found them to be sufficient for general use; that is, I think, the best test that can be applied. So far as "strictly scientific method of investigation" is concerned, I would say that if by "scientific" is meant "materialistic," it is impossible to give any proofs at all, but if it means the seeking of truth, we can see at once, in the case of the still-born child and the recently deceased adult, that something has not been imparted to the first and has departed from the second, and that something cannot be called nothing, seeing that it is *the* factor by which all movement and intelligence was made manifest.

The real difficulty has arisen from the determined exclusion of the ethereal from the scientific mind. It is often said by scientists that "where the supernatural begins, science ends," but surely everything on earth is natural, especially if it is alive. Spirit is natural and not unnatural. Individuality is natural, not unnatural or supernatural. Whilst the idea persists that there is something supernatural, so long will difficulty and stagnation exist. As soon as we realise that all that is on earth is natural, the innumerable difficulties that exist to-day will vanish. There is no dividing-line, for one seems to overlap and to intermingle with the other, yet they are separable—which is a paradox.

Yours, etc.,
SAMUEL GEORGE.

GLACK,
DEAL.
September 27, 1922.

ENGLISH PLACE-NAMES

To the Editor of DISCOVERY

SIR,

My letter in your last issue did not aim to give all the evidence I have available on the points I mentioned. Space forbade that, and my book on *Early British Trackways* was written (probably with many faulty place-name surmises) to explain and introduce this new framework for investigation.

As regards the Bowley place-names I mentioned, Canon Bannister (*Place-names of Herefordshire*) gives this same Bowley as being *Bolelei* in Domesday Book; and there is another ancient Bowley Lane in Herefordshire. Looking up the *bol* or *bole* place-names, I went to Bollingham (no old forms available) to find the bol, not recorded in map or record. But there it was, a conical tumulus in a shrubbery, close to chapel and house, with a summer-house and a dovecot on its apex. I investigated Bolitree, sometimes called a "castle"; the house is raised a little as if on a mound, and round it are traces of a moat.

My deductions about the meaning of the "red," "white," and other place-names have not started as a theory, as critics assume. I was not thinking about place-names at all until I found the straight tracks I had discovered (sighted over moats, mounds, etc.) also linked up in some cases place-names of one type. I should have been glad if place-names could have been kept out of the investigation altogether, but it was impossible, as they shout out to the investigator information which he cannot ignore.

Of course, the truth of what I pointed out all hangs upon the question whether straight-sighted prehistoric trackways really existed. I do not expect this to be fully accepted until well confirmed; and fortunately it is already receiving full confirmation from other observers—Mr. W. A. Dutt, of Lowestoft, author of *Highways and Byways in East Anglia*, for an instance.

Ought we not to recognise that a keen topographical knowledge and insight is not always joined in the same person with a skilled knowledge of words and their roots in the scholar's sense; and that, again, academic conclusions are often absurdly wrong for want of the special knowledge of the place, as well as that of the name? Here co-operation might score.

Yours, etc.,
ALFRED WATKINS.

HEREFORD,
November 3, 1922.

[Owing to lack of space we have unavoidably had to hold over to the January No. a most important letter from Prof. Mawer in answer to the above letter.]

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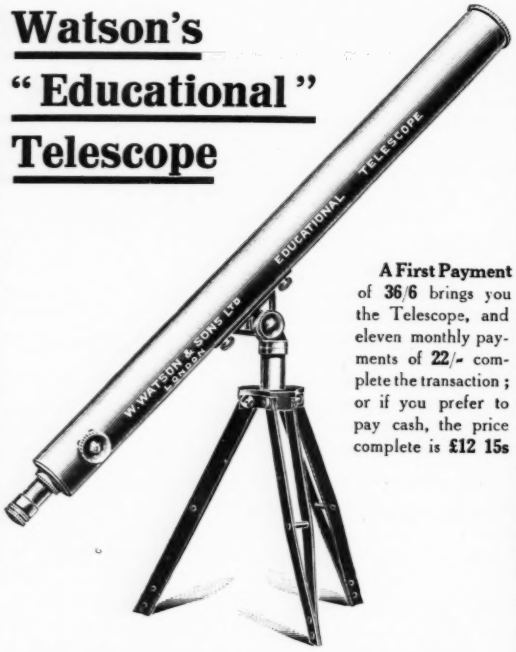

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